

PART III

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PART III

WATER SYSTEM SPECIFICATION AND DETAILS

SECTION 1: TOWN POLICY

1.1 Developer's Responsibility

It shall be the policy of the Town to require the developer and/or the developer's engineer to consult with the appropriate Fire Protection District to review any special conditions that exist or that should be addressed in the design of the Town's distribution system in the development.

1.2 Town Jurisdiction

The design criteria and construction specifications set forth in Part III are considered minimum requirements. The Town reserves the right to alter or add to the criteria and/or specifications based on site specific conditions or based on requests/requirements of the Water District.

SECTION 2: DESIGN CRITERIA & HYDRAULIC ANALYSIS PARAMETERS

2.1 Water Supply

Potable water is supplied to the Town of Firestone by the Central Weld County Water District (CWCWD). Firestone owns 700,000 gallons of capacity in a 5.0 MG steel above ground water tank. The water tank is located on Cleveland Hill (1/2 mile south of WCR 16 on WCR 17). The base of the tank is at an elevation of approximately 5100 MSL and is 40 feet tall.

2.2 Demand

Potable water system domestic demand criteria for the Town of Firestone is as follows:

Average Day Demand = 150 gal/day/cap. (assume 3.0 people per dwelling unit)

Maximum Day Demand = 2 x Avg. Day Demand

Peak Hour Demand = 1.5 x Max. Day Demand

2.3 Analysis

The following two conditions must be checked for the water distribution system, and documented in a hydraulic study of the proposed system:

- A. At peak hour demand the minimum residual pressure in the system must be 40 psi.
- B. For the maximum day demand + ISO fire flow the minimum residual pressure in the system must be 20 psi.

SECTION 3: WATER DISTRIBUTION SYSTEM

3.1 Definitions

Unless defined otherwise herein, all terms contained in this regulation shall have the meaning assigned to such terms by the Rules and Regulations of the Town.

“Approved” means accepted by the Town and the Water Quality Control Division as meeting the applicable specification stated or cited in this regulation, or as suitable for the proposed use.

“Auxiliary Water Supply” Any water supplies on or available to the premises other than the Town’s approved public potable water supply. These auxiliary waters may include water from another purveyor’s public potable water supply or any natural source(s) such as a well, spring, river, stream, etc., or “used waters” or “industrial fluids”. These waters may be polluted or contaminated or may be objectionable and constitute an unacceptable water source over which the Town does not have sanitary control.

“Backflow Preventer” A device or means designed to prevent backflow or back-siphonage.

“Air Gap” The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, or other device and the flood level rim of said vessel. An approved air-gap shall be at least double the diameter of the supply pipe, measured vertically, above the top of the rim of the vessel.; and, in no case less than one inch. When an air-gap is used at the service connection to prevent the contamination or pollution of the water system, an emergency by-pass shall be installed around the air-gap system and an approved reduced pressure principle device shall be installed in the by-pass system.

“Reduced Pressure Principle Device” An assembly of two independently operating approved check valves with an automatically operating differential relief valve between the two check valves, tightly closing shut-off-valves on either side of the check valves plus properly located test cocks for the testing of the check and relief valves. The entire assembly shall meet the design and performance specifications and approval of a recognized and Town approved testing agency for backflow prevention assemblies. The device shall operate to maintain the pressure in the zone between the two check valves at a level less than the pressure on the public water supply side of the device. At cessation of normal flow the pressure between the two check valves shall be less than the pressure on the public water supply side of the device. In case of leakage of either of the check valves, the differential relief valve shall operate to maintain the reduced pressure in the zone between the check valves by discharging to the atmosphere. When the inlet pressure is two pounds per square inch or less, the relief valve shall open to the atmosphere. To be approved, these devices must be readily accessible for in-line maintenance and testing and be installed in a location where no part of the device will be submerged.

“Double Check Valve Assembly” An assembly of two independently operating approved check valves with tightly closing shut-off valves on each side of the check valves plus properly located test cocks for testing of each check valve. The entire assembly shall meet the design and performance specifications and approval of a recognized and Town-approved testing establishment for backflow prevention devices. To be approved, these devices must be readily accessible for in-line maintenance and testing

“Back Pressure” means backflow caused by a pump, elevated tank, boiler or other means that could create pressure within the system greater than supply pressure.

“Backsiphonage” means the flow of water or other liquids, mixtures or substances into the distribution pipes of a water system from any source other than its intended source caused by the sudden reduction of pressure in the water system.

“Certified Inspector and/or Tester” means a person who has passed a State-approved and/or sponsored testing and/or inspection course and who is listed by the State as a certified inspector and/or tester.

“Check Valve” means a self-closing device, which is designed to permit the flow of fluids in one direction and to close if there is a reversal of flow.

“Colorado Department of Health Cross-Connection Control Manual” A manual that has been published by the State addressing cross-connection control practices which will be used as a guidance document for the agency in implementing a Cross-Connection Control Program.

“Contamination” means an impairment of the quality of the potable water by sage, industrial fluids or water liquids, compound or other materials to a degree which creates an actual hazard to the public health through poisoning or through the spread of disease.

“Critical Level” means the critical level C-L or C/L marking on a backflow prevention device or vacuum breaker which is a point conforming to approved standards and established by the testing laboratory (usually stamped on the device by the manufacturer), which determines the minimum elevation above the flood-level rim of the fixture or receptacle served at which the device may be installed. When a backflow prevention device does not bear a critical level marking, the bottom of the vacuum breaker, combination valve, or the bottom of any such approved device shall constitute the critical level.

“Cross-Connection” shall mean any unprotected, actual, or potential connection or structural arrangement between the Town’s water system, or a consumer’s potable water system and any other source, or system, through which it is possible to introduce into any part of the potable system any substance, other than the intended potable water, with which the system is supplied. By-pass arrangements, jumper connections, removable sections, swivel or changeover devices and other temporary, or permanent, devices through which, or because of the “backflow” can or may occur, are considered to be cross-connections.

“Cross-Connections - Controlled” A connection between a potable water system and a non-potable water system with an approved backflow prevention device properly installed that will continuously afford the protection commensurate with the degree of hazard.

“Flood-Level Rim” means the edge of the receptacle from which water overflows.

“Hazard, Degree Of” The term is derived from an evaluation of the potential risk to public health and the adverse effect of the hazard upon the water system.

“Hazard - Health” Any condition, device, or practice in the water system and its operation which could create, or in the judgment of the Town may create a danger to health hazard is a structural defect, including a cross-connections, in a water system.

“Hazard - Pollutational” An actual or potential threat to the physical properties of the water system or to the potability of the Town’s or the consumer’s potable water system but which would constitute a nuisance or be aesthetically objectionable or could cause damage to the system or its appurtenances, but would not be dangerous.

“Hazard - System” An actual or potential threat of severe damage to the physical properties of the water system or the consumer’s potable water system or of a pollution of contamination, which would have a protracted affect on the quality of the potable water in the system.

“Industrial Fluids System” Any system containing a fluid or solution which may be chemically, biologically or otherwise contaminated or polluted in a form or concentration such as would constitute a health, system, pollutational or plumbing hazard if introduced into an approved water supply. This may include, but not be limited to: polluted or contaminated waters; all types process waters and “use waters” originating from the water system which may have deteriorated in sanitary quality; chemicals in fluid form; plating acids and alkalies, circulated cooling waters connected to an open cooling tower and/or cooling towers that are chemically or biologically treated or stabilized with toxic substances; contaminated natural waters such as from wells, springs, streams, rivers, irrigation canals or systems, etc.; oils, gases, glycerine, paraffins, caustic and acid solutions and other liquid and gaseous fluids used in industrial or other purposes or for firefighting purposes.

“Non-Potable Water” means water that is not safe for human consumption or that is a questionable potability.

“Pollution” means the presence of any foreign substance (organic, inorganic, radiological or biological) in the water that may degrade the water quality so as to constitute a hazard or impair its usefulness.

“Potable Water” means water free from impurities in amounts sufficient to cause disease or harmful physiological effects. The bacteriological, chemical and radiological quality shall conform to State of Colorado Drinking Water Regulations.

“Submerged Inlet” means a water pipe or extension there to from a public water supply terminating in a tank, vessel, fixture or appliance which may contain water of questionable quality, waste or other contaminant and which is unprotected against backflow.

“Vacuum” means any pressure less than that exerted by the atmosphere.

“Vacuum Breaker, Atmospheric Non-pressure Type” means a vacuum breaker designed so as not to be subject to static line pressure or installed where it would be under pressure for not more than twelve hours in any twenty-four hour period.

“Vacuum Breaker, Pressure Type” means a vacuum breaker designed so as not to be subjected to static line pressure.

“Water-Service Connection” means the terminal end of a service connection from the water system; i.e., where the Town loses jurisdiction and sanitary control over the water at its point of delivery to the customer’s water system. If a meter is installed at the end of the service connection, then the service connection shall mean the downstream end of the meter. There shall be no unprotected takeoffs from the service line ahead of any meter backflow prevention device located at the point of delivery to the customer’s water system. Service Connection shall also include water service connection from a fire hydrant and all other temporary or emergency water service connections from the water system.

3.1.1 Town Utility System

The utility system shall consist of the Town’s water distribution system; and shall include all those facilities of the water system under the complete control of the Town up to the point where the customer’s system begins. The Town’s distribution system shall include the network of conduits used for the delivery of water from the source to the customer’s system.

3.1.2 Source Facilities

Source facilities are owned and operated by the CWCWD. The source facilities shall include all components of the facilities utilized in the production, treatment, storage, and delivery of water to the distribution systems.

3.1.3 Customer System

The customer system shall include those parts of the facilities beyond the termination of the distribution system, which are utilized in conveying Town delivered domestic water to points of use.

3.2 Service Line Requirements

- A. It shall be the builders’/contractors’ responsibility to protect the meter from freezing or other physical damage during construction and acceptance by the owner, it shall be the owner’s responsibility to protect the meter from freezing or other physical damage.
- B. Licenses and Permits Required: All water service installations shall be done by a contractor who has an individual working for him that possesses a current master plumber’s card and that individual shall personally accomplish or directly supervise the installation work.
- C. A connection permit shall be secured from the Town a minimum of three (3) days prior to construction, at which time the contractor shall familiarize himself with the standards and specifications, select and obtain approval of the appropriate standard water service installation for the building or facility, submit an appropriate set of mechanical plans, inform the Town Clerk of the intended schedule for construction, and present the appropriate trade card.
- D. Where a street cut is required for water service, the contractor shall rebuild the road base in accordance with Part II, Section 4 of the Firestone Design Criteria & Construction Regulations.

- E. All permits, fees, and licenses shall be paid for by the contractor, plumber or other doing work in the Town prior to the start of construction.

3.2.1 Water Lines

- A. Water lines may be either ductile iron pipe (DIP) or polyvinyl chloride (PVC) pipe. Refer to specification Section 02615 and 02622 for pipe requirements.
- B. Standard distribution lines shall have an inside diameter of 8 inches.
- C. Distribution lines may need to be larger than 8 inch to provide fire flows or adequate pressures.
- D. Six-inch distribution lines may be acceptable only in cul-de-sacs and only after the developer's engineer has provided an analysis that shows adequate flows and pressures will be provided. The appropriate fire protection district must consent to this line size.
- E. Distribution lines shall be located within street R.O.W. under the pavement. A minimum horizontal separation between the water line and any other utility in the street shall be 10 feet. The water line shall also not be closer than 5 feet to the flowline of the curb and gutter
- F. When conditions require that a waterline be installed outside of a street R.O.W., the waterline is to be centered in a minimum 20-foot wide exclusive easement. Waterlines outside of street R.O.W. should be avoided and the Town reserves the right to not allow them when another option is available.
- G. All water lines shall have tracer wire attached to the pipe. Tracer wire shall be extended to the surface at all hydrants within an enclosed riser.

3.2.2 Valves

- A. The distribution system shall be valved such that future repairs or maintenance may be isolated with disruption of service to as few customers as possible.
- B. Minimum valving of the distribution system would involve a gate valve on each line at "tees" and crosses.
- C. Appurtenant valves such as air relief/vacuum relief valves, check valves, pressure reducing valves, etc. shall meet the requirements of specification Section 02641. The necessity and location of these valves will be evaluated on a site by site basis.

3.2.3 Fire Safety Requirements

- A. All subdivisions shall be required to provide minimum fire protection as required by the appropriate fire protection district.
- B. Fire hydrants shall be spaced no more than 500 feet for residential and 300 feet for commercial or as directed by the Fire District.

- C. Minimum water line size shall be six (6) inches.
- D. Fire hydrants that have two and one-half (2-1/2) inch outlets shall have the National Standard Thread. Four and one-half (4-1/2).
- E. Minimum residual pressure of 20 psi during max day + fire flow at the fire hydrants will be required to provide minimum fire protection.
- F. Fire hydrants shall be located on dedicated street rights-of-way and be accessible to the standard fire pumper.
- G. No surface features or utilities shall be installed within 5-feet of a fire hydrant.

3.3 Service Installation Requirements

- A. Water service lines shall be located so as to take the shortest, most direct route (preferably perpendicular to the main) from the water main to the building. The service line shall be located such that the meter pit is not under any paved driveway or service road. All water service lines shall have a minimum cover of five (5) feet. No service lines shall be laid parallel to or within three (3) feet of any bearing wall, which might be thereby weakened. The water service shall be laid at uniform grade and in straight alignment.
- B. All meters shall be installed by a Town representative. Under supervision of the Town's Inspector, the water service line is to be pressure tested at normal operating pressure from the water main to the control valve and checked for leaks.
- C. Service Line and Control Valves: The water service line shall be soft Type K copper. The service line shall have a control valve located at the property line with easy access to the Town and said valve shall be located on an appropriate improvements survey, a copy of which shall be forwarded to the Town. Two splices in the service line are allowed every 100 feet. No soldered joints will be allowed underground. Pack joints or approved equal shall be the only acceptable joints. No joints are allowed between the main and the curbstop.
- D. Pressure Reducing Valves: Individual pressure reducing valves shall be installed when required. On all new construction, the pressure-reducing valve shall be upstream from the meter.
- E. Excavation: All excavations required for the installation of water service shall be open trench work unless otherwise approved by the Town. Pipe laying and backfill shall be performed in the manner described in this manual. All excavations for water service installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways, and other public or private property disturbing the course of the work shall be restored in a manner satisfactory to the Town.
- F. Tapping the Main: The Maintenance Supervisor of the Town, or his designated representative, is the sole individual authorized to supervise or make taps onto the Town's water mains. The applicants of the building water service permit shall notify the

Maintenance Supervisor when the service is ready for inspection and connection to the main.

- G. Surface Restoration: Paving, curb and gutters, sidewalk, improved services, or other street improvements removed, damaged, or destroyed during construction shall be replaced to the same elevation and alignment with the same type and dimensions as units removed and shall be equal to and consistent with the undisturbed portions of the improvements existing prior to trench excavation. Debris shall be removed from the site of the work at the expense of the contractor.
- H. Maintenance of Backfill and Surface Warranty: All backfill shall be maintained in a satisfactory condition and all places showing signs of settlement shall be filled and maintained during construction and for a period of one year following the completion of construction except that the warranty period for settlement in asphalt surface streets shall be two years. When the Town notifies the applicant that any backfill is hazardous, he shall correct such hazardous condition at once.
- I. Street Cut Permits: Street cuts permits, and accompanying obligations, are solely the responsibility of the applicant.

3.4 Inspection & Quality Control

- A. All work shall be inspected by the Town's representative who shall have the authority to halt construction when, in his opinion, the Town's Rules and Regulations, these specifications or proper construction practices are not being adhered to. Whenever any such violation occurs, the Town's representative shall, in writing, order further construction to cease until all deficiencies are corrected.
- B. Except as otherwise provided, no pipe shall be covered without observation by a representative of the Town. Anyone making any installation without such observation shall be required to remove all topsoil or any other covering placed over this facility to be inspected at his own expense.
- C. The Town water system shall be protected from cross-connection and backflow contamination or pollution. The contractor shall isolate within its customers' internal distribution system(s) or its customers' private water system(s) such contaminants or pollutants, which could backflow or backsiphon into the water system.
- D. The contractor shall provide for the maintenance of a continuing program of cross-connection control which will systematically and effectively prevent cross-connections, actual or potential, between its customers' in-plant potable water system(s) and non-potable water systems, plumbing fixtures and industrial piping systems.
- E. All water service line construction shall be done in accordance with these specifications and all other Rules and Regulations of the Town. The scope of these specifications shall include all new water service line installations from the Town mains to the associated plumbing of the building or any other facility requiring water use.

WATER SYSTEM CONSTRUCTION SPECIFICATIONS

Section 01060 - Regulatory Requirements

Section 01071 - Abbreviations

Section 01656 - Disinfection of Domestic Water Lines

Section 01666 - Testing Piping System

Section 02615 - Ductile Iron Pipe

Section 02622 - Plastic Pipe

Section 02641 - Valves

Section 02644 - Hydrants

Section 02710 - Water Distribution and Transmission Lines

Refer to Appendix V for other applicable specifications.

WATER DISTRIBUTION SYSTEM

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 General

- A. All public works construction within the boundaries of the Town of Firestone shall be performed in accordance with the requirements of these specifications.

1.2 Approved Plans

- A. Public works construction shall be done in accordance with engineered construction drawings for the work prepared by an engineer registered in the State of Colorado and approved by the Town.

1.3 Notice Before Beginning Work

- A. The contractor shall notify the Town Clerk at least 24 hours before beginning any construction. If for any reason work should stop on a project during any stage of construction for a period of more than forty eight (48) hours, it shall be the responsibility of the contractor to notify the Town at least forty eight (48) hours to any resumption of work on the project. The contractor may work extended shifts, double shifts, or hours other than the normal workday of Town personnel only with written permission from the Town, except in the event of an emergency.
- B. When Inspectors are required to work overtime, it shall be at the contractor's expense.

1.4 Inspection

- A. All work shall be inspected by a representative of the Town who shall have the authority to halt construction when, in his opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated the Town, by written notice, shall order further construction to cease until all deficiencies are corrected. If deficiencies are not corrected, performance shall be required of the contractors surety.

1.5 Warranty and Acceptance

- A. The contractor shall warrant all work to be free of defects in workmanship or materials for a period of one year from the date of completion of all construction. If work meets these Specifications, a preliminary letter of acceptance shall be given at the time of completion. A final acceptance letter shall be given upon final inspection at the end of the warranty period. All defective work shall be corrected by the contractor before final acceptance.
- B. The determination of the necessity for the contractor to repair or replace the work in whole or in part during the warranty period shall rest entirely with the Town whose decision in the matter shall be final and obligatory upon the Contractor.
- C. Corrections of defective work shall be warranted for one year.

END OF SECTION

SECTION 01070

ABBREVIATIONS

PART 1 - GENERAL

- 1.1 Wherever used in these specifications the following abbreviations shall have the meanings indicated

| | |
|-------|---|
| YACHT | American Association of State Highway & Transportation Officials |
| APWA | American Public Works Association |
| ASTM | American Society for Testing and Materials |
| AWWA | American Water Works Association |
| DIP | Ductile Iron Pipe |
| ISO | Insurance Services Office |
| MSS | Manufacturer's Standardization Society of the Valves and Fittings |
| NFPA | National Fire Protection Association |
| PVC | Poly Vinyl Chloride Pipe |

END OF SECTION

SECTION 01656

DISINFECTION OF DOMESTIC WATER LINES

PART 1 - GENERAL

1.1 Description

- A. This section covers disinfection of potable water distribution and transmission lines.
- B. The Town shall employ and pay for a water quality lab to perform all of testing required by this section. The Developer shall be responsible for reimbursing the Town for all costs associated with water quality testing.
- C. The Contractor shall contact both the Town and the Town's water quality lab to arrange for testing at least 48 hours prior to testing.

1.2 Submittals

- A. Certification: Submit manufacturer's certification that materials conform to specified requirements.

1.3 Product Delivery, Storage and Handling

- A. Exercise extreme care in handling of hypochlorites as they may be dangerous to health.

PART 2 - PRODUCTS

2.1 Materials

- A. Hypochlorites: Reference AWWA C651-86

PART 3 - EXECUTION

3.1 General

- A. Flush and satisfactorily disinfect new water lines prior to placing in service in accordance with AWWA C651-86.
- B. Clean and swab the interior of the pipe, fittings, valves, or appurtenances with a 5 percent (50,000 ppm) hypochlorite disinfecting solution if dirt, trench water, or other contaminants enter the pipe or will not be removed by flushing operations.
- C. Manipulate valves to prevent the disinfection solution from flowing back into the line supplying the water or into adjacent parts of the inservice distribution system.
- D. Operate valves and appurtenances while the lines are filled with chlorinated water.

3.2 Flushing

- A. Preliminary flushing: Flush pipelines at a minimum velocity of 2.5 ft/sec to remove foreign material prior to disinfection.
 - 1. Do not use preliminary flushing if the tablet method of disinfection is approved by Engineer.
- B. Final flushing: Flush chlorinate water from the lines after chlorination until the chlorine concentration is no higher than that prevailing in the system, or less than 1 mg/l, whichever is higher.

3.3 Methods

- A. In general, apply chlorine using the continuous feed method.
 - 1. Slug method may be used on large diameter pipe where continuous feed is not practical.
 - 2. Tablet method may be used on short extensions up to 2500 feet of water lines 12 inch and smaller.
- B. Continuous Feed Method
 - 1. Introduce chlorinated water into the lines at a constant rate so that the chlorine concentration in the water lines is maintained at a minimum of 50 mg/l available chlorine.
 - 2. Fill the entire main with the chlorine solution.
 - 3. Retain the chlorinated water in the main for at least 24 hours at which time the treated water shall contain no less than 25 mg/l chlorine throughout the length of the main.
- C. Slug Method
 - 1. Introduce chlorinated water into the lines at a constant rate so that the chlorine concentration in the water lines is maintained at a minimum of 300 mg/l available chlorine.
 - 2. Apply for a sufficient period of time to develop a solid column of chlorinated water that will expose all interior surfaces for a period of at least 3 hours.
 - 3. Measure chlorine residual at the upstream end of the line.
- D. Tablet Method
 - 1. Do not use if trench water or foreign material has entered the line or if the water temperature is below 5° C (41° F).
 - 2. Use only when scrupulous cleanliness has been exercised due to the fact that preliminary flushing is not possible with this method.
 - 3. Place tablets in each section of pipe, hydrants, hydrant leads, and other appurtenances in sufficient number to produce a minimum chlorine concentration of 50 mg/l. Reference table 4, AWWA C651-86.

4. Attach tablets, except in hydrants and joints, with an adhesive on the tablet except on the broad side next to the pipe surface.
5. Introduce water into the lines at a velocity less than 1 ft/sec.
6. Retain the water in the lines a minimum of 24 hours at which time the treated water shall contain no less than 25 mg/l chlorine throughout the main.

3.4 Bacteriologic Tests

- A. Collect samples from the end of the pipeline after final flushing and prior to placing water lines in service and test for bacteriologic quality to show the absence of coliform organism.
 1. Collect samples in sterile bottles from a corporation stop with a copper tube gooseneck assemble installed in the main.
 2. Do not collect samples from a hydrant or hose.
- B. The number and frequency of samples shall conform to the requirements of the public health authority.
 1. In no case shall the number be less than one(1) sample for lines with chlorinated supplies and two (2) samples collected 24 hours apart for unchlorinated supplies.

3.5 Repetition Of Procedure

- A. Repeat disinfection until satisfactory samples have been obtained if the initial disinfection or subsequent disinfections fail to produce satisfactory samples.

END OF SECTION

SECTION 01666

TESTING PIPING SYSTEM

PART 1 - GENERAL

1.1 General

- A. Description: This section covers the hydrostatic testing of water distribution and transmission lines.
- B. Conduct pressure test and leakage test concurrently.
- C. Do not test until at least 7 days have elapsed after the 1st concrete thrust restraint has been cast.
 - 1. 36 hours minimum shall elapse if high-early-strength cement is used.
- D. Conduct tests in increments not to exceed 2 miles of pipe as construction progresses.
- E. No allowance shall be made for pressure reductions accomplished by means of pressure reducing valves or other mechanical means.
- F. Prior to tests Contractor and Engineer shall inspect valves within the test section to make sure they are fully open.
 - 1. Hydrants: Test with the hydrant main valve closed and the auxiliary line valve open.

1.2 Pressure Test

- A. Preparation:
 - 1. Slowly fill pipe with water.
 - 2. Remove all air.
 - a. Install corporation cocks at high points to evacuate the air if permanent air vents are not located there.
 - 3. Leave pipe filled with water at working pressure for a minimum of 24 hours prior to the hydrostatic pressure test.
- B. Test Pressure:
 - 1. For steel pipe, ductile iron pipe and PVC pipe, use a test pressure of 1½ times the working pressure measured at the lowest elevation of the pipeline test section or the working pressure plus 50 psi, whichever is greater.
 - 2. Maintain the test pressure within ± 5 psig of the test pressure for at least 2 hours.

1.3 Leakage Test

- A. Definition: Leakage is the quantity of water that must be added to the pipeline to maintain pressure within 5 psi of the specified test pressure after the air has been expelled and the pipe is filled with water.
- B. Maximum allowable leakage:
- For ductile iron pipe and PVC pipe:

$$L = \frac{ND(P^{1/2})H}{7400}$$

where:

- L = Maximum allowable leakage in gallons.
 N = Number of joints in the length of pipeline tested.
 D = Nominal pipe diameter in inches.
 P = Average test pressure during the leakage test in psig.
 H = Number of test hours.

| GALLONS (G) OF ALLOWABLE LEAKAGE PER 100 COUPLINGS PER HOUR* | | | | | | | | | |
|---|------|------|-------|-------|-------|-------|-------|-------|-------|
| Average Test Pressure at Lowest Point in Line - psi | | | | | | | | | |
| Pipe Diameter Inches | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 |
| 4 | 0.71 | 0.87 | 1.00 | 1.12 | 1.23 | 1.32 | 1.42 | 1.51 | 1.58 |
| 6 | 1.06 | 1.29 | 1.51 | 1.68 | 1.84 | 1.98 | 2.12 | 2.25 | 2.37 |
| 8 | 1.42 | 1.72 | 2.00 | 2.24 | 2.45 | 2.64 | 2.84 | 3.00 | 3.16 |
| 10 | 1.77 | 2.15 | 2.50 | 2.79 | 3.07 | 3.40 | 3.54 | 3.75 | 3.95 |
| 12 | 2.12 | 2.58 | 3.00 | 3.35 | 3.68 | 3.96 | 4.24 | 4.52 | 4.74 |
| 14 | 2.48 | 3.01 | 3.50 | 3.91 | 4.28 | 4.62 | 4.96 | 5.26 | 5.50 |
| 16 | 2.83 | 3.44 | 4.01 | 4.47 | 4.89 | 5.27 | 5.68 | 6.00 | 6.32 |
| 18 | 3.18 | 3.87 | 4.52 | 5.02 | 5.52 | 5.93 | 6.37 | 6.75 | 7.11 |
| 20 | 3.54 | 4.30 | 5.00 | 5.58 | 6.12 | 6.58 | 7.08 | 7.51 | 7.90 |
| 21 | 3.73 | 4.54 | 5.24 | 5.88 | 6.40 | 6.92 | 7.42 | 7.86 | 8.28 |
| 24 | 4.24 | 5.16 | 6.00 | 6.69 | 7.34 | 7.91 | 8.50 | 9.01 | 9.47 |
| 27 | 4.77 | 5.83 | 6.74 | 7.56 | 8.23 | 8.90 | 9.54 | 10.12 | 10.66 |
| 30 | 5.30 | 6.45 | 7.51 | 8.37 | 9.18 | 9.88 | 10.62 | 11.26 | 11.84 |
| 33 | 5.83 | 7.13 | 8.24 | 9.25 | 10.06 | 10.88 | 11.67 | 12.36 | 13.02 |
| 36 | 6.37 | 7.75 | 9.01 | 10.07 | 11.02 | 11.88 | 12.74 | 13.50 | 14.22 |
| 39 | 6.88 | 8.42 | 9.74 | 10.83 | 11.90 | 12.96 | 13.79 | 14.61 | 15.40 |
| 42 | 7.42 | 9.08 | 10.48 | 11.78 | 12.82 | 13.85 | 14.86 | 15.74 | 16.58 |

- The data are based on 150 psi and represent a leakage of approximately 30 gpd per mile of pipe per inches of pipe diameter for pipe in 13 foot lengths.

2. When testing against closed metal-sealed valves, an additional leakage per closed valve of 0.0078 gal/hour/inch of nominal valve size will be allowed.

1.4 Acceptance

- A. Acceptance shall be on the basis of maximum allowable leakage.
- B. Locate and repair defective materials and joints if the tests discloses leakage greater than that specified.
- C. Repeat tests until the leakage is within the permitted allowance.

END OF SECTION

SECTION 02615

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 Description

- A. This section covers ductile iron pipe fittings, flanges, specials, and other accessories.

1.2 Product Delivery, Storage and Handling

- A. Handling:

1. Use slings, pipe tongs or skids.
2. Do not drop pipe or fittings including dropping on old automobile tire or other cushions.
3. Do not skid or roll pipe into pipe already on the ground.
4. Do not damage coating or lining.
5. Do not use hooks.

- B. Storage:

1. Maintain lubricant in a sanitary condition during storage.
2. Store rubber gaskets in a cool, dark location away from grease, oil, and ozone producing electric motors and the direct rays of the sun.
3. Do not exceed maximum stacking heights listed in AWWA C600, Tables 1 and 2.

1.3 Alternatives

- A. Grooved end couplings may be used in lieu of flanged joints. Where flanged couplings adapters are indicated harnessed mechanical couplings shall be used.

PART 2 - PRODUCTS

2.1 Pipe

- A. Pipe:

1. Standard: ANSI 21.51 (AWWA C151).

- B. Flanged pipe (vaults only, not allowed for direct bury):

1. Standard: ANSI 21.15 (AWWA C151), flat faced.

2.2 Fittings

A. Flanges, mechanical joint, push-on:

1. Standard: ANSI A21.10 (AWWA C110).
2. Material: Ductile Iron.
4. Pressure rating: 250 psi, 12 in. & smaller; 150 psi, over 12 in.

B. Threaded:

1. Standard: ANSI B16.4, ANSI B16.14.
2. Pressure rating: 175 psi.

2.3 Joints

A. Mechanical and push-on:

1. Standard: ANSI A21.11 (AWWA C111)
2. Gaskets: Synthetic Rubber.
3. Lubricant: Furnished by pipe manufacturer.
4. Provide joint retainer gland on all exposed mechanical joints unless tie rods are indicated on the Drawings.

B. Flanged:

1. Standard: ANSI A21.15.
2. Flanges: ANSI B16.1.
3. Drilling: 125 LB., unless otherwise indicated.

2.4 Couplings

A. Mechanical couplings:

1. Type: Mechanical compression sleeve.
2. Omit pipe stop unless indicated otherwise on the Drawings.
3. Gaskets: Synthetic Rubber.
4. Dresser Style 38, Smith-Blair Type 411 Baker Series 400, or equal.

B. Flanged coupling adapters:

1. 3 in. through 12 in.: Dresser Style 127; Smith-Blair Type 912; or equal with locking pins unless otherwise required.
2. Over 12 in: Dresser Style 128; Smith-Blair Type 913, or equal.
3. Gaskets: Synthetic Rubber.

C. Transition couplings:

1. Dresser Style 162, or equal.

D. Wall castings:

1. Mechanical Joint with waterstop and tapped holes.
2. Plug all holes with plastic plugs.

E. Grooved end couplings:

1. Pipe ends: Rigid Groove sizes 2 in. through 24 in. Shouldered for sizes over 24 in.
2. Couplings: Victaulic Style 31, 3 in. through 24 in. Victaulic Style 41, over 24 in.

2.5 Pipe Lining

A. Cement mortar:

1. Standard: ANSI A21.4.
2. Thickness: Standard.

B. Polyethylene:

1. Standard: ASTM D1248, Class C, fused on.
2. Thickness: 20 mil.

2.6 Pipe Coatings

A. Underground or submerged locations (PE sock will be required on all DIP unless specifically waived by the Town):

1. Type: Bituminous.
2. Thickness: Approximately 1. mil.

B. Exposed Locations:

1. Pipe: Primer; Tnemec "77 Chem-Prime, Mobil "13-R-50 Chromox Q.D.," or approved equal.
2. Flange faces: Rust-Oleum "R-9." Houghton "Rust Veto 344," or approved equal.

2.7 Accessories

A. Tie rods:

1. Rods: ASTM A307.
2. Steel pipe: ASTM A120, standard weight.
3. Washers: ANSI B27.2, plain steel.

B. Cable bond connectors:

1. Capacity: 500 amps.
2. Bond: Cadweld brazing cartridges.

- C. Polyethylene tubing:
 - 1. Standard: ANSI 21.5 (AWWA C105)
 - 2. Method: A.

PART 3 - EXECUTION

3.1 Inspection

- A. Examine pipe and fittings and do not use individual section's containing:
 - 1. Cracks.
 - 2. Flaws.
 - 3. Broken or loose lining.
 - 4. Other defects.
- B. Mark defective pipe and remove from the site.
- C. Cutting the Pipe
 - 1. Cut pipe smooth, straight, and at right angles to the pipe axis.
 - 2. Do not damage the pipe and or cement lining.
 - 3. Use a saw, abrasive wheel, or oxyacetylene torch for ductile iron pipe.
 - 4. Do not use an oxyacetylene torch for cutting holes for saddles.
 - 5. Grind cut ends and rough edges smooth.
 - 6. Bevel the cut end for push-on joints.
- D. Polyethylene Encasement:
 - 1. Install polyethylene encasement on ductile iron pipe where required by ANSI/AWWA C105/A21.5-82.
 - 2. Cut polyethylene tube to a length approximately 2 feet longer than that of the pipe section.
 - 3. Slip the tube around the pipe, centering it to provide a 1 foot overlap on each adjacent pipe section, and bunching it according fashion lengthwise until it clears the pipe ends.
 - 4. A shallow bell hoe must be made at joints to facilitate installation of the polyethylene tube.
 - 5. After assembling the pipe joint, make the overlap of the polyethylene tube.
 - 6. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place.
 - 7. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe.
 - 8. Secure the overlap in place.
 - 9. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

3.3 Joint Installation

A. General:

1. Use push-on or mechanical joints in underground locations, unless otherwise required.
2. Use flanged joints at other locations unless otherwise required.
3. All joints shall be watertight and free from leaks.
4. Repair each leak discovered immediately.
5. Block, anchor, or harness all mechanical couplings, and push-on or mechanical joints.
6. Do not deflect joints beyond the maximum values specified in AWWA C-600, Tables 5 and 6.

B. Push-on joints:

1. Clean the inside of the bell and the outside of the spigot to remove dirt, oil, excess coating and other foreign matter.
2. Insert the gasket.
3. Apply a thin film of lubricant to either the inside surface of the gasket, the spigot end of the pipe or both.
4. Do not permit the joint surfaces to come in contact with the ground.
5. Assure that pipe is marked with a depth mark before assembly to assure the spigot end is inserted the full depth of the joint.
6. Complete the joint making certain the spigot is inserted to the depth mark.

C. Mechanical joints:

1. Remove all dirt, oil, grit, excess coating and other foreign matter from the inside of the bell and the outside of the spigot.
2. Apply a thin film of lubricant to the inside of the bell, the outside of the spigot and the gasket.
3. Tighten nuts alternately on opposite sides of the pipe to produce equal pressure on all parts of the gland.
4. Use a torque limiting wrench and do not exceed the maximum torque value listed in AWWA C600 Table 4.
5. Holes in mechanical joint bells shall straddle the top (or side for vertical piping) centerline.

D. Flanged joints:

1. Extend pipe completely through screwed-on flanges.
2. Machine finish the pipe end and flange face in a single operation.
3. Eliminate any restraints on the pipe which would prevent uniform gasket compression or cause unnecessary stress in the flanges.
4. Do not assemble mechanical connections until all flanged joints affected thereby have been tightened.
5. Alternately tighten bolts spaced on opposite sides of the pipe to assure uniform gasket compression.
6. Holes in flanges shall straddle the top (or side for vertical piping) centerline.

E. Mechanical couplings:

1. Clean and smooth pipe ends.
2. Allow $\frac{1}{4}$ inch minimum to one inch maximum space between pipe ends.

END OF SECTION

SECTION 02622

PLASTIC PIPE

PART 1 - GENERAL

1.1 Description

- A. This section covers plastic pressure and non-pressure pipe and fittings to be furnished complete with all jointing materials.

1.2 Product Delivery, Storage and Handling

- A. Do not damage the pipe by impact, bending, compression or abrasion during handling and storage.
- B. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging.
- C. Do not stack pipe higher than 5 feet.
- D. Do not store pipe and fittings in direct sunlight for periods in excess of two weeks.
- E. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.
- F. Use only nylon protected slings or hands to handle pipe. Do not use hooks or bare cables.

PART 2 - PRODUCTS

2.1 Plastic Pressure Pipe (4" and Larger)

- A. Conform to: AWWA C900 and C905.
 - 1. Pressure Class: 150 psi, DR 18.
 - 2. Joints: Gasket bell end or gasket couplings.

2.2 Plastic Pressure Pipe (3 in. and smaller)

- A. Conform to: ASTM D2241.
 - 1. Pressure Class: 125 psi, SDR 32.5.
 - 2. Joints: Gasket bell end, or gasket couplings.

PART 3 - EXECUTION

3.1 Inspection

- A. Examine pipe and fittings and do not use individual sections containing:
 - 1. Cracks.
 - 2. Dents.
 - 3. Abrasions.
 - 4. Other defects.
- B. Mark rejected pipe and remove from the site.

3.2 Installation

- A. Install pipe in accordance with Section 02710.
- B. Cutting the Pipe:
 - 1. Cut pipe square with saw or pipe cutter designed specifically for the material.
 - 2. Bevel the end in accordance with the manufacturer's recommendations.
 - 3. Remove burrs and wipe off all dust and dirt from the jointing surfaces.
- C. Jointing the Pipe:
 - 1. Remove all dirt and foreign material from the pipe ends, gasket and gasket groove.
 - 2. Apply lubricant furnished by the pipe manufacturer to the spigot end of the pipe.
 - 3. Insert the spigot to the reference mark.
 - 4. Do not disturb previously installed joints during jointing operations.
- D. Install tracer wire or metallic tape in trench with PVC pipe not under a paved street. If tracer wire is not attached to the pipe it shall be buried directly above the pipe with a minimum of two feet of cover.
 - 1. If tracer wire is used it is to be exposed above the finished grade at both ends of the pipe installation and prominently marked with flagging.

3.3 Field Quality Control

- A. Leakage Tests: Refer to Section 01666 for pressure pipelines.

END OF SECTION

SECTION 02641

VALVES

PART 1 - GENERAL

1.1 Description

- A. This section covers valves, valve operators, valve boxes, and appurtenances used for the water distribution system.

1.2 Product Delivery, Storage and Handling

- A. Take precautions so as not to damage materials during delivery or storage.
- B. Store valves off the ground and away from materials that could contaminate potable water systems.
- C. Take precautions to keep joints and internal parts clean.

PART 2 - PRODUCTS

2.1 Gate Valves

- A. Conformance: AWWA C500.
 - 1. Type: double discs, parallel seats, resilient seats.
 - 2. Stem seal: O-ring.
 - 3. Direction of opening: open left.
 - 4. Valve ends: conform to the type of pipe material used.
 - 5. Operator: Underground - 2" nut; Vault - Handwheel.

2.2 Butterfly Valves

- A. Conformance: AWWA C504.
 - 1. Type: conform to the type of pipe material used flanged valves shall be short body, with resilient seats.
 - 2. Type of shaft seal: O-ring seals.
 - 3. Type of operator: Underground - 2" nut; vault-handwheel.
 - 4. Direction of opening: open left.
 - 5. Operator torque: reference AWWA C504, Appendix A, design the required operator torque to the higher valve given by the following two formulas:
 - a. $To = (Tb + Ts + Th).$
 - b. $To = (1.2 Tb + Td).$

2.3 Valve Boxes

A. Materials and construction:

1. Type: Cast iron or ductile iron, extension sleeve type.
2. Shaft size: 5 1/4 inch minimum.
3. Thickness: 3/16 inch minimum at any point.
4. Furnish with suitable cast iron bases and covers.
5. Cast appropriate name designation of service in cover.
6. Coating: Dip in bituminous varnish.

2.4 Air Relief/Vacuum Valves

A. Materials and construction:

1. Type: Integral type assembly which functions both as an air release and vacuum valve.
2. Rating: working pressure of 150 psi and a minimum hydrostatic test pressure of 250 psi.
3. Outlet capacity: 30 cubic feet of free air per second.
4. Connections:
 - a. Inlet: 2 inches, screwed (AWWA C800).
 - b. Outlet: Protect to minimize entry of debris and dirt.
5. Body: cast iron or ductile iron.
6. Working parts and seats: brass, stainless steel, or non-corroding material.
7. Float: non-corroding, stainless steel.
8. Watertight at 200 psi.

B. Acceptable manufacturers:

1. Crispin Universal Air Valve, by Multiplex Manufacturing.
2. Apco Combination Air Release Valve, by Valve and Primer Corporation.
3. Approved equal.

2.5 Pressure Relief Valve

A. Materials and construction:

1. Type: Integral type assembly to open cover and allow outside water pressure to enter empty tank.
2. Body: Iron.
3. Dimensions: 4" diameter 10" body length.
4. Open at head of 9" of water.

B. Acceptable manufacturers:

1. Clow F-1492 by Clow Corporation.
2. Or equal.

2.6 Check Valves

- A. Acceptable check valves and their manufacturers are:
 - 1. Watts
 - 2. Febco
 - 3. Mueller, "Detector Gravity".
 - 4. Furnish adjustable stem and operating handwheel.
- B. All check valves shall be rated at a working pressure of 150 psi.

2.7 Curb Stops

- A. All curb stops shall have compression connections at both ends.
- B. The top threads for all curb stops shall be Minneapolis type.
- C. Curb stops shall be used for taps which are 2 inches and smaller.
- D. Acceptable curb stop manufacturers are:
 - 1. Mueller;
 - 2. Ford;
 - 3. A.Y. McDonald;
 - 4. Approved equal.

2.8 Tapping Saddles

- A. All tapping saddles shall have a bonze body, with bronze double flat straps and bronze nuts.
 - 1. Outlet threads on tapping saddles shall be "cc" type only.
- B. Acceptable manufacturers of tapping saddles are:
 - 1. Mueller;
 - 2. Ford;
 - 3. Approved equal.

PART 3 - EXECUTION

3.1 Valve Boxes

- A. Install valve boxes on buried valves.
- B. Install so that no stress is transmitted to valve.
- C. Set plumb and directly over the valve with the top between $\frac{1}{4}$ inch and $\frac{1}{2}$ inch below finished grade. Install 8" thick concrete collar with valve box lid.
- D. Install extended stems on valves where operating nut is more than 4 feet below finished grade.

3.2 Air Relief/Vacuum Valves

- A. Install at high points where required.

END OF SECTION

SECTION 02644

HYDRANTS

PART 1 - GENERAL

1.1 Description

- A. This section covers dry-barrel fire hydrants intended for use in public water supply systems where freezing temperatures occur.

1.2 Product Delivery, Storage and Handling

- A. Handle, store and protect in a manner to prevent damage to materials, coatings, and finishes.
- B. Do not drop or dump materials into trench.
- C. Keep fittings and joints free from dirt.

PART 2 - PRODUCTS

2.1 General

- A. Conformance: AWWA C502.
- B. Acceptable manufacturers:
 - 1. Mueller, No. A24015.
 - 2. Mueller, No. A-423
 - 3. Waterous Pacer, WB-100
 - 4. Or approved equal.

2.2 Materials and Construction

- A. Type: dry barrel with break-away traffic flange.
- B. Outlet size: 2-2½ inch hose nozzles and 1-4 ½ inch pumper nozzle.
- C. Outlet threads: Conformity with NFPA No. 194.
- D. Hydrant size: 5¼ inch.
- E. Shoe inlet size: 6 inch, mechanical joint with retainer gland.
- F. Bury: 5½ feet.
- G. Operation: open left.

- H. Color: red.
- I. Operating nut: 1½" inch pentagon.

PART 3 - EXECUTION

3.1 Installation

- A. Set Plumb.
- B. Set Traffic Flange 0.1 feet to 0.2 feet Above Finished Grade.
- C. Reference The Details in this manual.

3.2 Operation

- A. Hydrants Shall Be Fully Closed Or Fully Open.
- B. Do Not Operate Hydrants Partially Open.
- C. Once in service, only the Town or the Fire District shall operate hydrants unless express permission is otherwise granted (i.e...issuance of a town hydrant meter).

END OF SECTION

SECTION 02710

WATER DISTRIBUTION AND TRANSMISSION LINES

PART 1 - GENERAL

1.1 Description

- A. This section covers the installation of water distribution and transmission lines.

1.2 Quality Assurance

- A. Do not deviate from alignment more than 0.5 feet.
- B. Do not deviate from grade more than 0.3 feet where the pipeline is laid to grade.
 - 1. Measure at the pipe invert for grade, not at the top of pipe.

1.3 Job Conditions

- A. Prevent foreign material from entering the pipe.
- B. Do not place debris, tools, clothing, or other material in the pipe.
- C. Close the open ends of pipe with a blocked, watertight plug when pipe laying is not in progress to prevent the entrance of water, debris, and animals into the pipe.
 - 1. Do not remove the plug, if water is present in the trench, until the trench is pumped dry.
- D. Use effective measures to prevent uplifting or floating of the pipeline prior to completion of backfilling operations.
- E. Do not lay pipe under the following conditions:
 - 1. In water.
 - 2. Unsuitable weather conditions.
 - 3. Unsuitable trench conditions.

PART 2 - PRODUCTS (NOT USED) SEE SECTIONS 02615, 02622 and 02641.

PART 3 - EXECUTION

3.1 Preparation

- A. Perform trenching, backfilling and compaction in accordance with Section 02221.
- B. Connections: Where connections are to be made to existing pipes or appurtenances, the exact location of which cannot be determined without exposing the existing pipe or appurtenance, excavate and expose the existing improvement before installing any pipe.
 - 1. The Town will examine the existing pipe or appurtenance and specify any necessary adjustments in line or grade of the proposed pipe to accomplish the connection.

3.2 Pipe Installation

- A. Pipe laying:
 - 1. Lay pipe with the bells pointing the direction the Work is progressing.
 - a. On down slopes of 10 percent or more:
 - 1) Hold the last pipe laid in place by some means, such as a winch, while joining the next pipe to it to prevent moving or reverse the direction of pipe laying.
 - 2) Take effective measures to prevent opening of joints during bedding and backfilling operations.
 - 2. Complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade as each length of pipe is placed in the trench.
 - a. Make adjustments in line and grade by scraping away or filing pipe bedding under the entire length of the pipe, except at bells, and not by wedging, blocking, or mounding up the pipe or bells.
 - 3. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints.
 - a. Do not disturb the pipe after the jointing has been completed.
 - 4. Install the pipeline so that a positive or negative grade is maintained between high and low points.
 - a. Record the location of high and low points so they may be readily located if permanent air vents or blow-offs are not provided.
 - 5. Provide a minimum depth of cover from finished grade to top of pipe of 5 feet.
 - 6. Maximum depth of cover shall be 6 feet unless approved by the Town.
- B. Connections to existing pipelines:
 - 1. Make each connection at a time authorized by Owner which will least interfere with service.
 - 2. Use suitable fittings for the conditions encountered.
 - 3. Dewater and dispose of water from dewatered lines.
 - 4. Use effective measures to prevent contamination to existing potable water lines.

- a. Do not permit trench water, mud or other contaminating substances to enter pipelines.
- 5. Swab the interior of new pipe, fittings, and valves installed in existing pipelines with a solution of 5 percent (50,000 ppm) chlorine solution prior to installation.
- 6. Only the Town shall operate existing valves, hydrants, blow-offs, curb stops, and other control units unless written permission from the Town is given in advance.

C. Encasements:

- 1. Provide concrete encasement where indicated on the Drawings or required by these Specifications.
- 2. Sewerline Crossings.
 - a. Where watermain cross sewer lines, and the sewer is above the watermain or less than 18 inches clear distance vertically below the watermain, construct the crossing by one of the following methods:
 - 1) Install one length of ductile iron pipe in the sewer line centered on the intersection with the watermain. Ductile iron pipe shall be the same size as sewer line, or nearest size larger, than sewer line. Use approved adapters for joints between the ductile iron pipe and the sewer line or encase the joints in a concrete collar.
 - 2) Encase the sewer pipe with reinforced concrete at least 6 inches thick at all locations within 10 feet either side of the watermain. See the encasement detail in this Appendix.
 - b. Provide suitable backfill or other structural protection to preclude settling or failure of higher pipe.

3.3 Anchorage and Blocking

- A. Provide concrete thrust blocks and anchors for preventing pipe movement at push-on or mechanical joint plugs, tees, crosses, bends deflecting 11¼ degrees or more, reducers and valves installed in piping subjected to internal hydrostatic pressure in excess of 13 psi.
 - 1. Tie concrete anchors to fittings, reducers, and valves by 2 "U" shaped No. 5 rebars.
 - a. Bend ends of rebar 90 degrees out, length 3 inches.
 - b. Rebar embedment: one-half pipe O.D. plus 6 inches.
- B. Provide a concrete thrust block under flanged valves that have valve boxes.
- C. Extend concrete from the fitting or valve to solid undisturbed earth.
 - 1. Construct so joints and drain holes are clear and accessible.

**RESULTANT THRUST IN POUNDS
AT FITTINGS WITH 100 PSI WATER PRESSURE**

| Diameter Inches | 22 1/2° Bend | 45° Bend | 67 1/2° Bend | 90° Bend | Tees or Dead Ends |
|--|-----------------|-------------|-----------------|-------------|----------------------|
| 4" | 660 | 1,320 | 1,900 | 2,440 | 1,720 |
| 6" | 1,470 | 2,910 | 4,200 | 5,370 | 3,800 |
| 8" | 2,550 | 5,040 | 7,300 | 9,300 | 6,580 |
| 10" | 3,640 | 7,190 | 10,400 | 13,270 | 9,380 |
| 12" | 5,170 | 10,240 | 14,800 | 18,860 | 13,330 |
| 14" | 6,000 | 11,750 | 17,100 | 21,800 | 15,400 |
| 16" | 7,800 | 15,350 | 22,300 | 28,400 | 20,000 |
| 18" | 9,900 | 19,400 | 28,200 | 36,000 | 25,450 |
| 20" | 12,200 | 24,000 | 34,800 | 44,400 | 31,400 |
| 24" | 17,600 | 34,600 | 50,100 | 64,000 | 45,200 |
| 30" | 27,400 | 54,000 | 78,300 | 100,000 | 70,700 |
| 36" | 39,500 | 77,600 | 113,000 | 144,000 | 101,800 |
| 42" | 54,000 | 106,000 | 153,500 | 196,000 | 138,500 |
| 48" | 70,500 | 138,000 | 200,000 | 262,000 | 181,000 |
| 54" | 8,9000 | 175000 | 254,000 | 323,000 | 229,000 |
| 60" | 110,000 | 216,000 | 314,000 | 400,000 | 282,700 |
| 66" | 133,000 | 262,000 | 380,000 | 484,000 | 342,000 |
| 72" | 158,000 | 311,000 | 450,000 | 575,000 | 407,000 |
| 78" | 185,500 | 365,000 | 530,000 | 675,000 | 477,800 |
| 84" | 216,000 | 424000 | 615,000 | 784,000 | 554,200 |
| 90" | 247,000 | 486,000 | 70,5000 | 900,000 | 636,200 |
| 96" | 281,000 | 553,000 | 800,000 | 1,020,000 | 723,800 |
| 108" | 358,000 | 701,000 | 1,019,000 | 1,298,000 | 916,000 |
| 120" | 442,000 | 865,000 | 1,258,000 | 1,600,000 | 131,000 |
| 132" | 535,000 | 1,050,000 | 1,522,000 | 1,940,000 | 1,368,000 |
| 144" | 636,000 | 1,248,000 | 1,810,000 | 2,305,000 | 1,628,600 |
| 156" | 747,000 | 1,461,000 | 2,040,000 | 2,705,000 | 1,911,300 |
| 168" | 868,000 | 1,700,000 | 2,466,000 | 3,141,000 | 2,216,700 |
| 180" | 995,000 | 1,950,000 | 2,830,000 | 3,600,000 | 2,544,700 |
| 192" | 1,131,000 | 2,220,000 | 3,220,000 | 4,100,000 | 2,865,200 |
| 204" | 1,279,000 | 2,505,000 | 3,640,000 | 4,630,000 | 3,268,500 |
| 216" | 1,430,000 | 2,805,000 | 4,075,000 | 5,190,000 | 3,644,300 |
| 228" | 1,595,000 | 3,125,000 | 4,540,000 | 5,770,000 | 4,082,800 |
| 240" | 1,770,000 | 3,465,000 | 5,040,000 | 6,410,000 | 4,523,900 |
| Table from "Welded Steel Water Pipe Manual", 1970, page 33 | | | | | |
| (Table above indicates values for different fittings). | | | | | |

Values: 4" - 12" = Pressure calculated at seal on O.D. of class 100 A.C. Pipe, reference Johns-Mansville Installation Manual; page 55.

14" - 240" = Pressure calculated on Pipe I.D.

Specifier - Safe Bearings Load: the following values are the ultimate bearing capacity of the soils divided by two for a safety factor.

| SAFE BEARING LOADS | |
|------------------------------------|--------------------------------------|
| Soil | Safe Bearing Load Lb. per Sq. Ft. |
| Muck, peat, etc. * | 0 |
| Soft clay | 1,000 |
| Sand | 2,000 |
| Sand and gravel | 3,000 |
| Sand and gravel cemented with clay | 4,000 |
| Hard shale | 10,000 |

D. Minimum bearing surface area is shown on the thrust restraint detail in this manual.

3.4 Installation of Pipeline Appurtenances

A. Install valves, meters, hydrants, and other equipment appurtenants to the water distribution and transmission lines at the locations shown on the Drawings or as designated by the Town to accommodate field conditions.

1. Record measurements of actual location of appurtenant equipment prior to backfill.

3.5 Protection of Metal Surfaces

A. Apply two coats of coal tar paint to ferrous metal rods, rebar, clamps, bolts, nuts and other accessories subject to submergence or contact with earth or fill material and not incised in concrete.

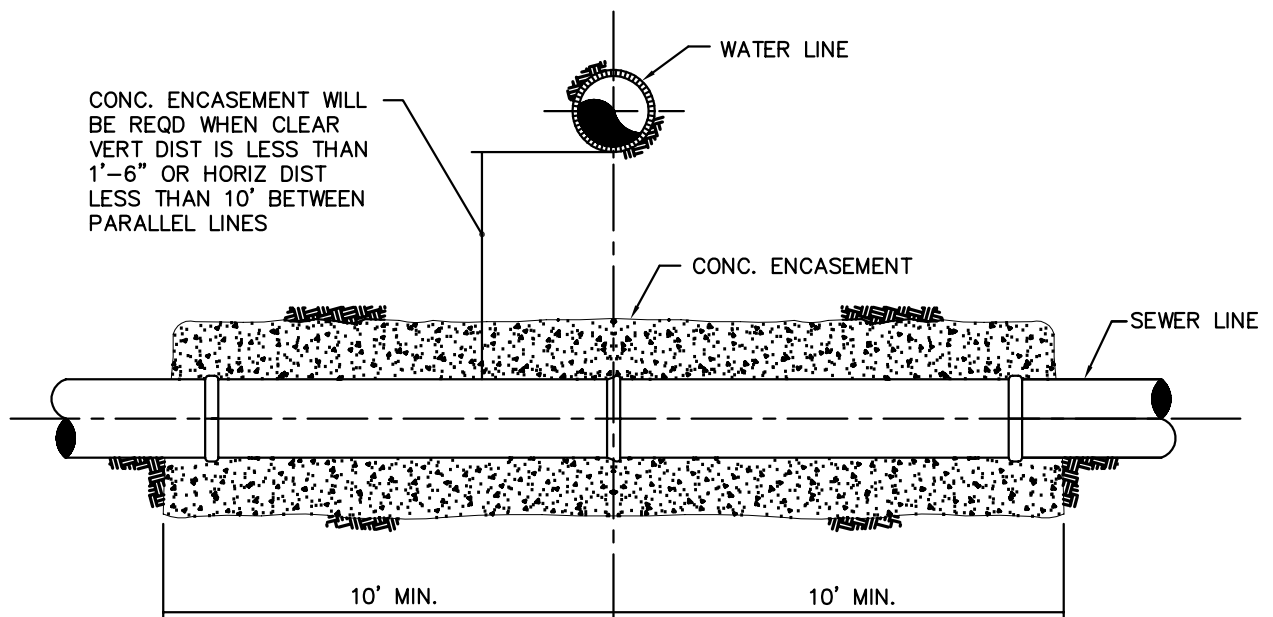
1. Apply first coat to dry, clean surface.
2. Allow first coat to dry before applying second coat.

B. Loose polyethylene encasement:

1. Standard: AWWA C105.
2. Methods, any of the following:
 - a. A or B (tube type encasement involving advancing a bunched length of material around each length of newly laid pipe).
 - b. C (sheet encasement wrapped around newly laid pipe to produce an overlapping seam at top of pipe).
3. Repair rips, punctures or other damage with adhesive tape or with a short length of polyethylene encasement wrapped around pipe and secured in place.
4. Maintain a sealed encasement with the polyethylene taped to the pipe at exist lines at the end of the encasement section.
5. Use loose polyethylene encasement at the following locations:
 - a. Valves and fittings with flanges or mechanical joints.
 - b. Bolted fittings, such as couplings.
 - c. Tie rods and joint harnesses.

6. Use loose polyethylene encasement on cast iron pipe and ductile iron pipe at the following locations.

END OF SECTION



NOTE:
 CONC. ENCASEMENT
 REQD IN ALL CASES
 WHERE SEWER LINE
 IS ABOVE WATER LINE

CONCRETE ENCASEMENT DETAIL

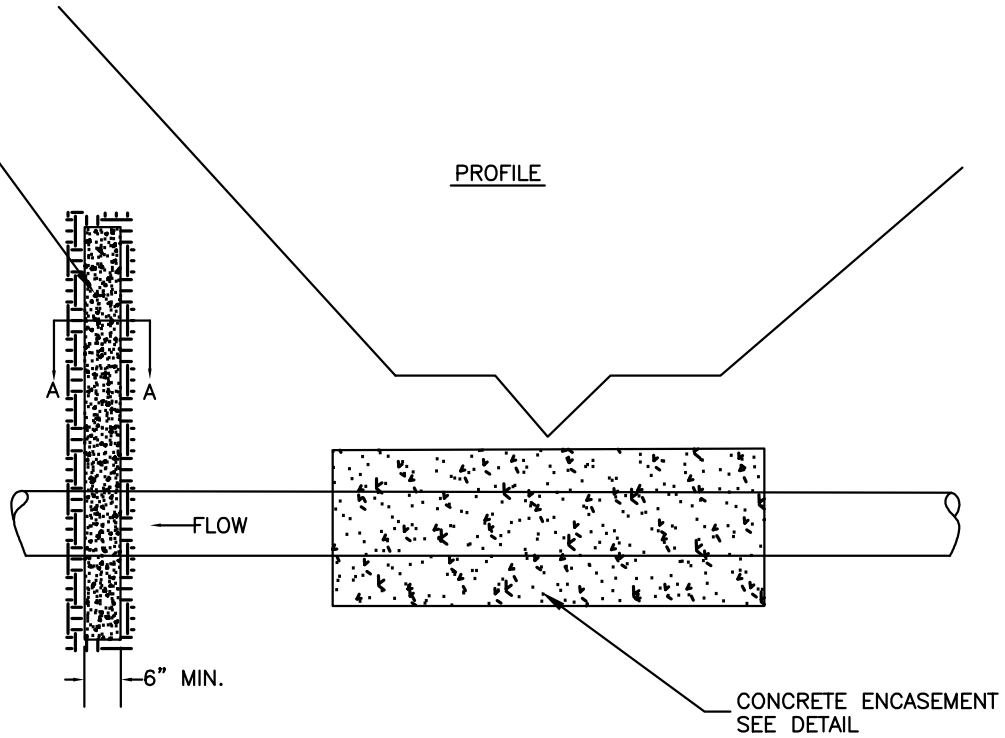
*TOWN OF
 FIRESTONE*

*UTILITY ENCASEMENT
 DETAIL*

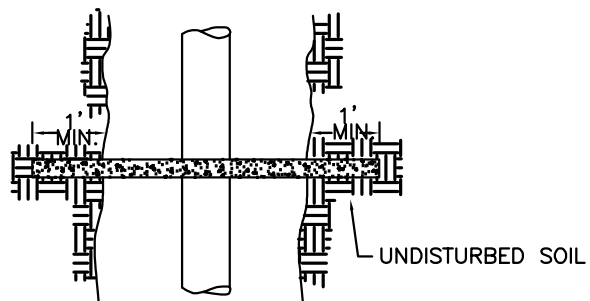
APPROVED BY: MAYOR

TST

SEE PLAN AND PROFILE
SHEET FOR TOP AND
BOTTOM OF WALL
ELEVATIONS



SECTION A-A



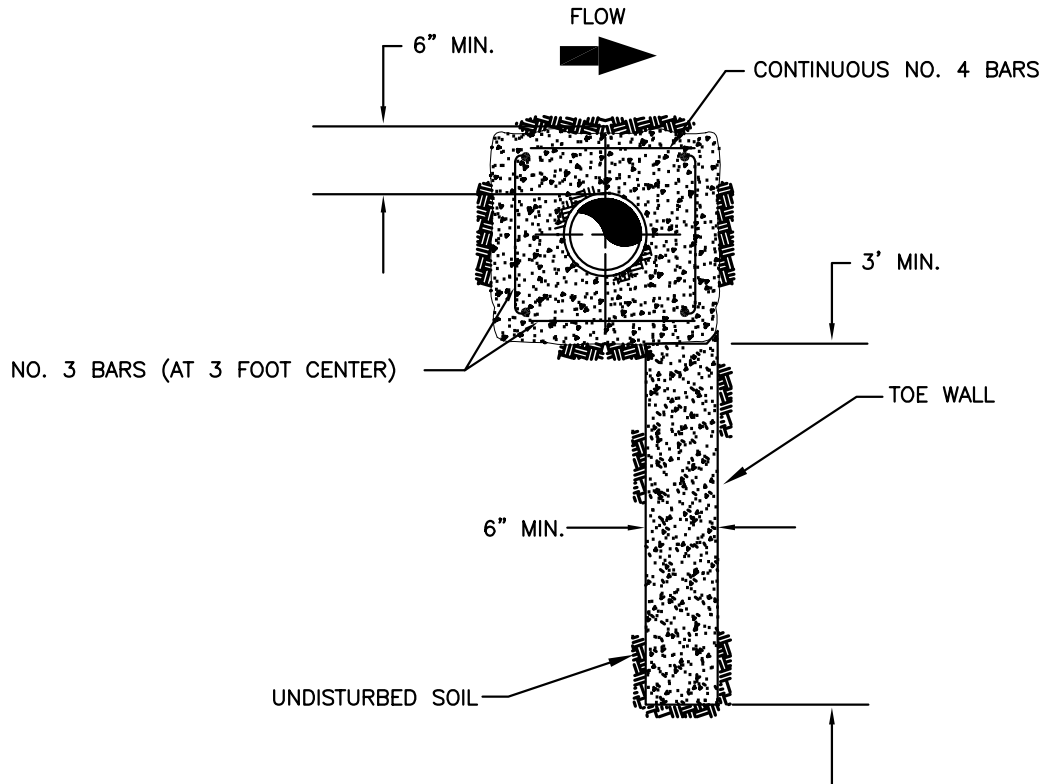
*TOWN OF
FIRESTONE*

*DITCH CROSSING
DETAIL*

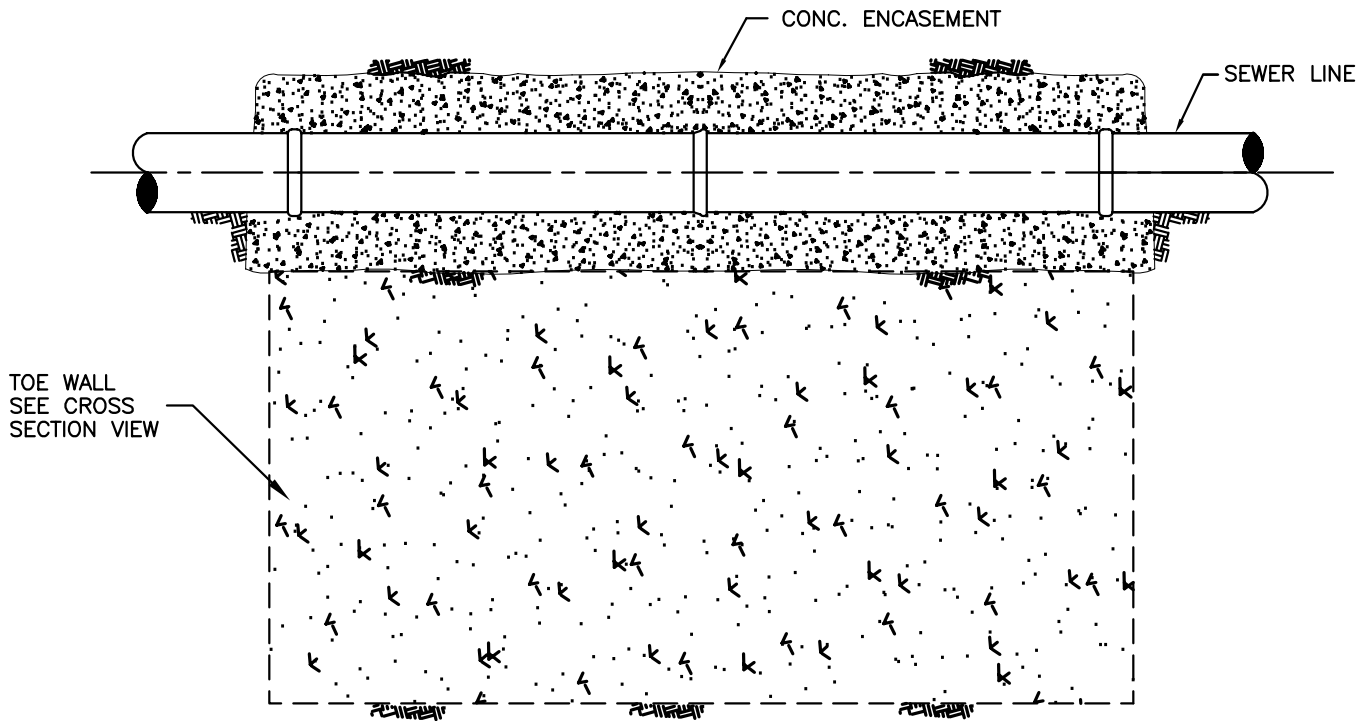
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CROSS SECTION



PROFILE

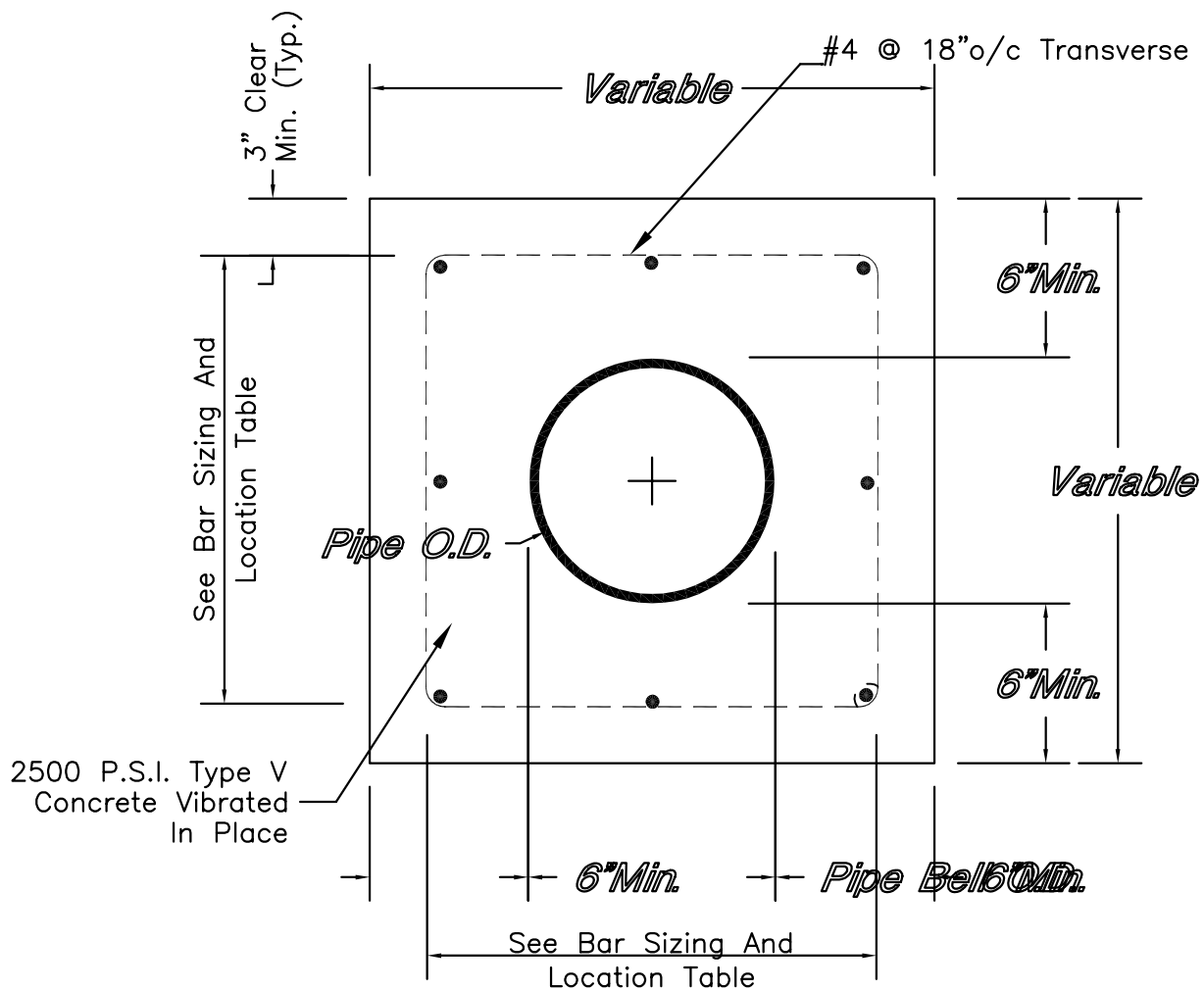


*TOWN OF
FIRESTONE*

*DITCH CROSSING
ENCASEMENT DETAIL*

APPROVED BY: MAYOR

TST



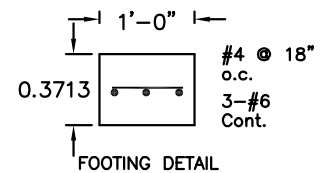
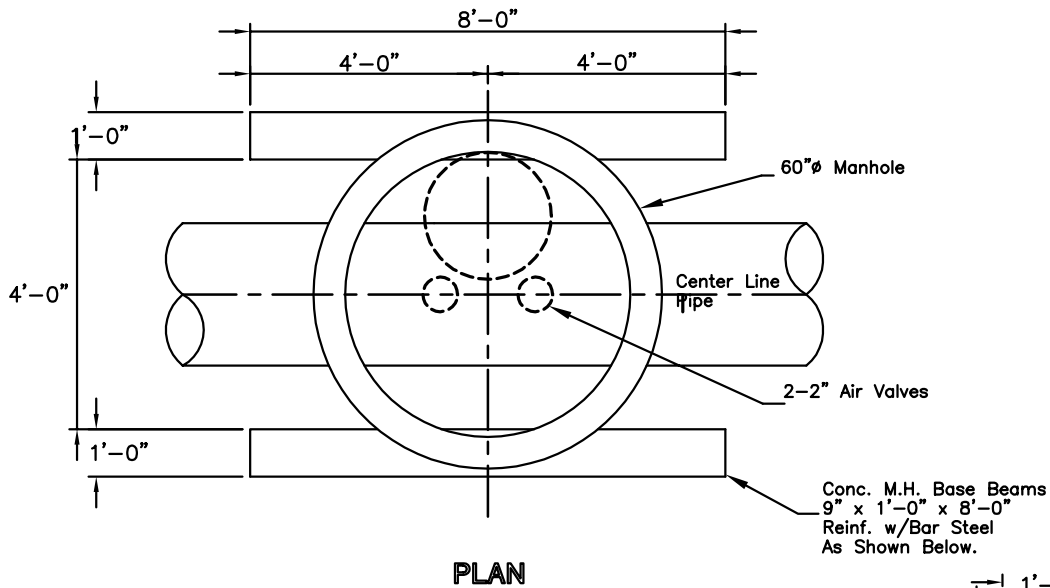
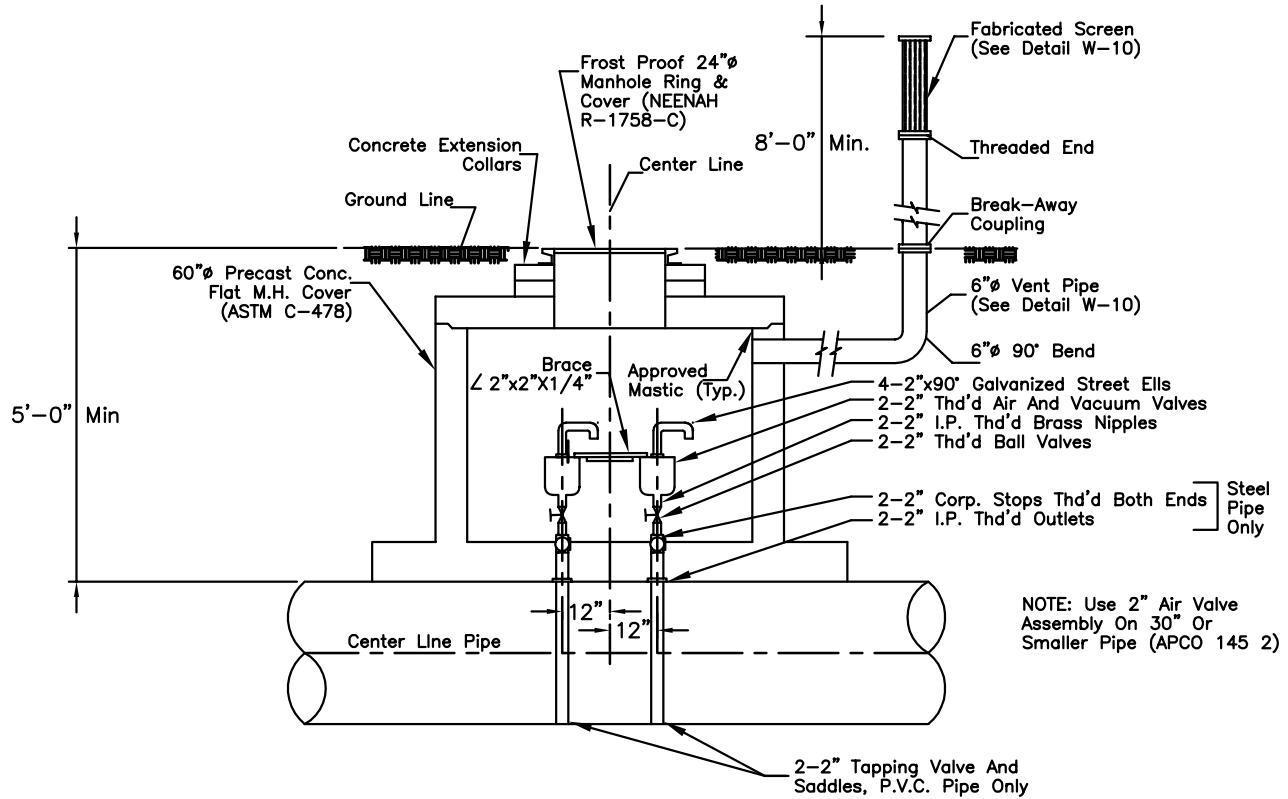
| PIPE I.D. | LONGITUDINAL BARS – LOCATION | |
|-----------|------------------------------|---------------|
| 6 IN. | 4-#4 BARS | 1 EACH CORNER |
| 8 IN. | 4-#4 BARS | 1 EACH CORNER |
| 10 IN. | 8-#4 BARS | 3 EACH SIDE |
| 12 IN. | 8-#4 BARS | 3 EACH SIDE |
| 15 IN. | 8-#4 BARS | 3 EACH SIDE |
| 18 IN. | 8-#4 BARS | 3 EACH SIDE |
| 21 IN. | 12-#4 BARS | 4 EACH SIDE |
| 24 IN. | 12-#4 BARS | 4 EACH SIDE |
| 27 IN. | 12-#4 BARS | 4 EACH SIDE |
| 30 IN. | 12-#4 BARS | 4 EACH SIDE |
| 33 IN. | 12-#4 BARS | 4 EACH SIDE |
| 36 IN. | 16-#4 BARS | 5 EACH SIDE |

*TOWN OF
FIRESTONE*

*CONCRETE
ENCASEMENT*

APPROVED BY: MAYOR

TST

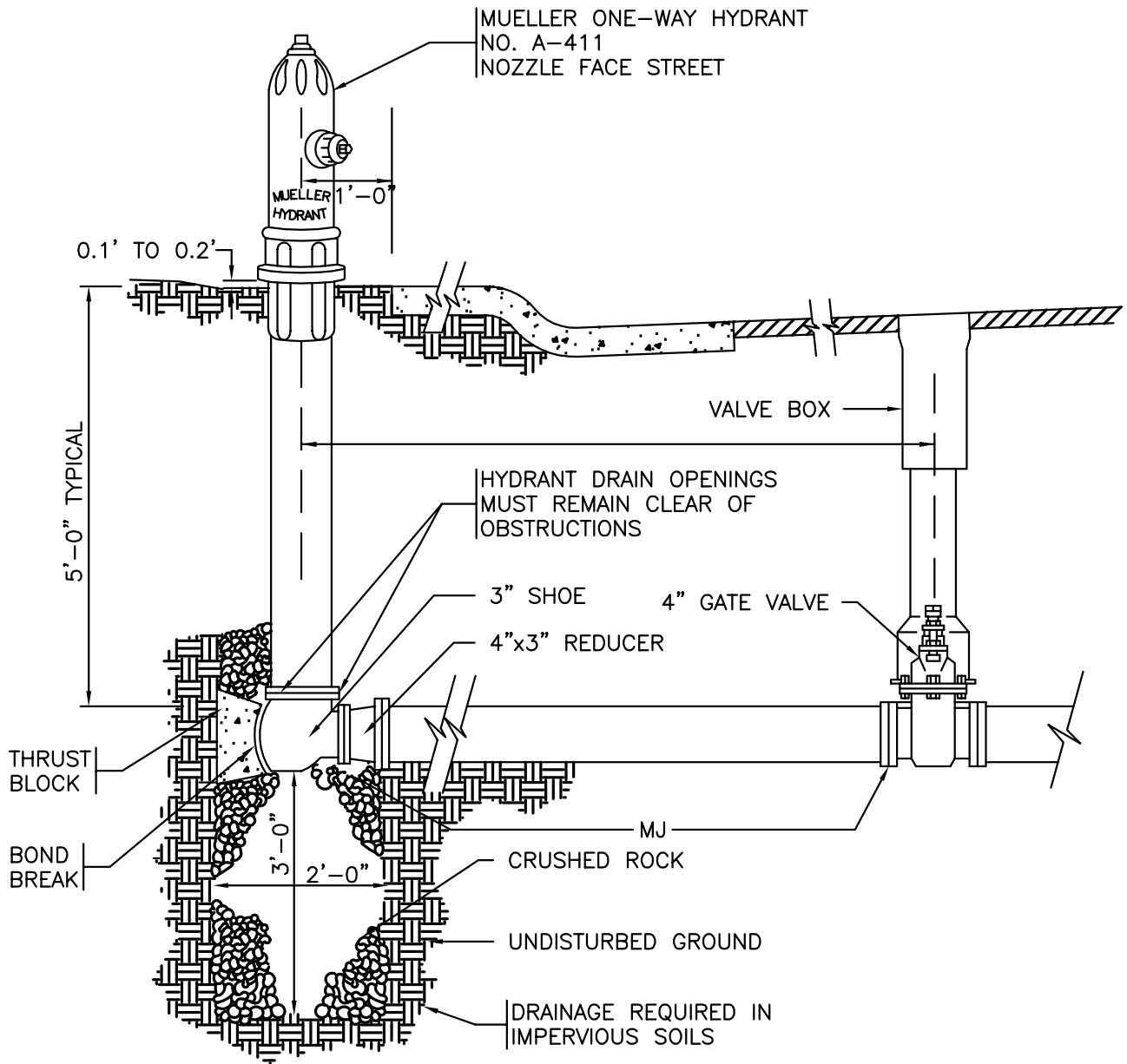


**TOWN OF
FIRESTONE**

**AIR AND VACUUM
VALVE DETAIL**

APPROVED BY: MAYOR

TST



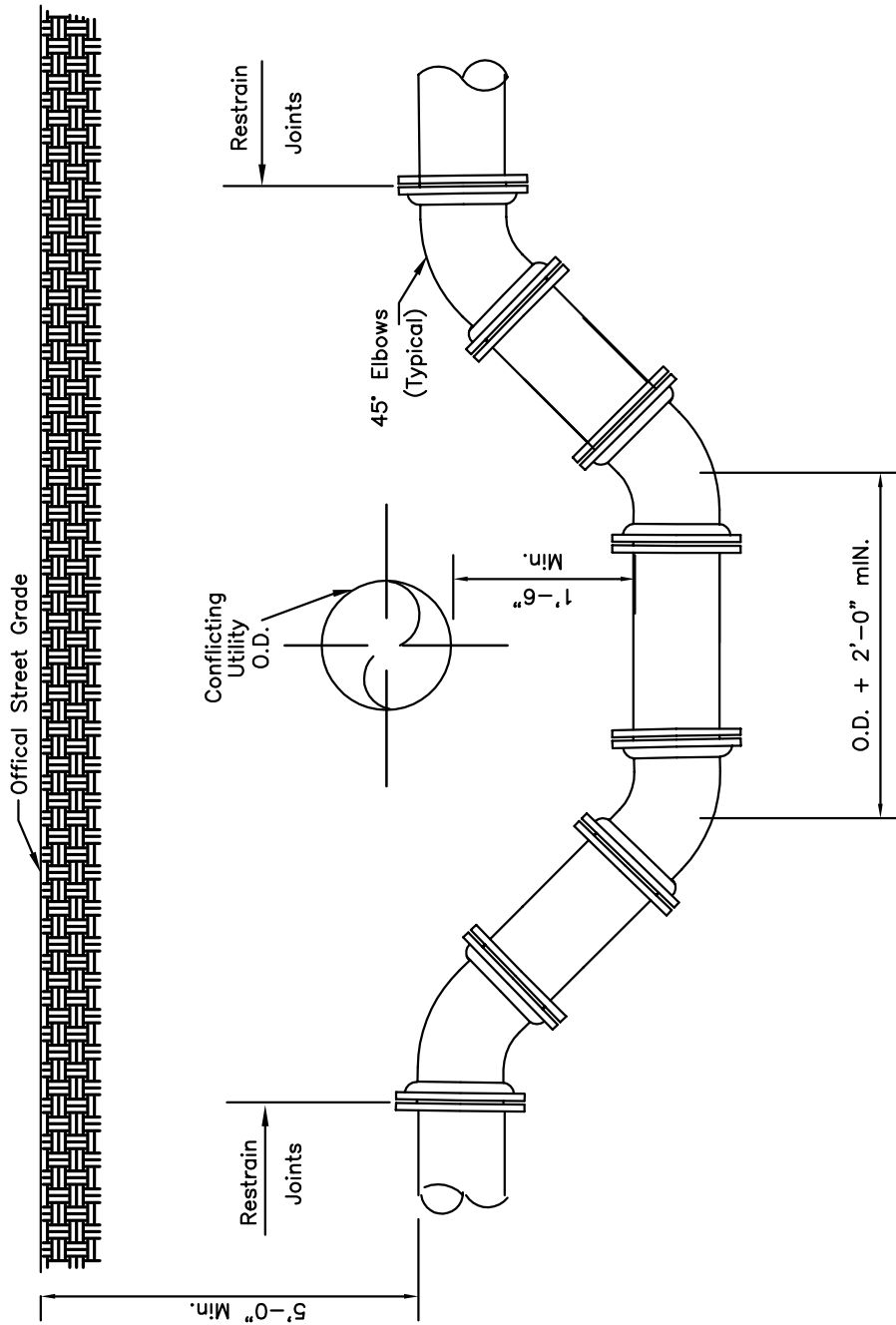
DISTRIBUTION LINES

*TOWN OF
FIRESTONE*

*TYPICAL BLOWOFF
INSTALLATION*

APPROVED BY: MAYOR

TST



NOTES:

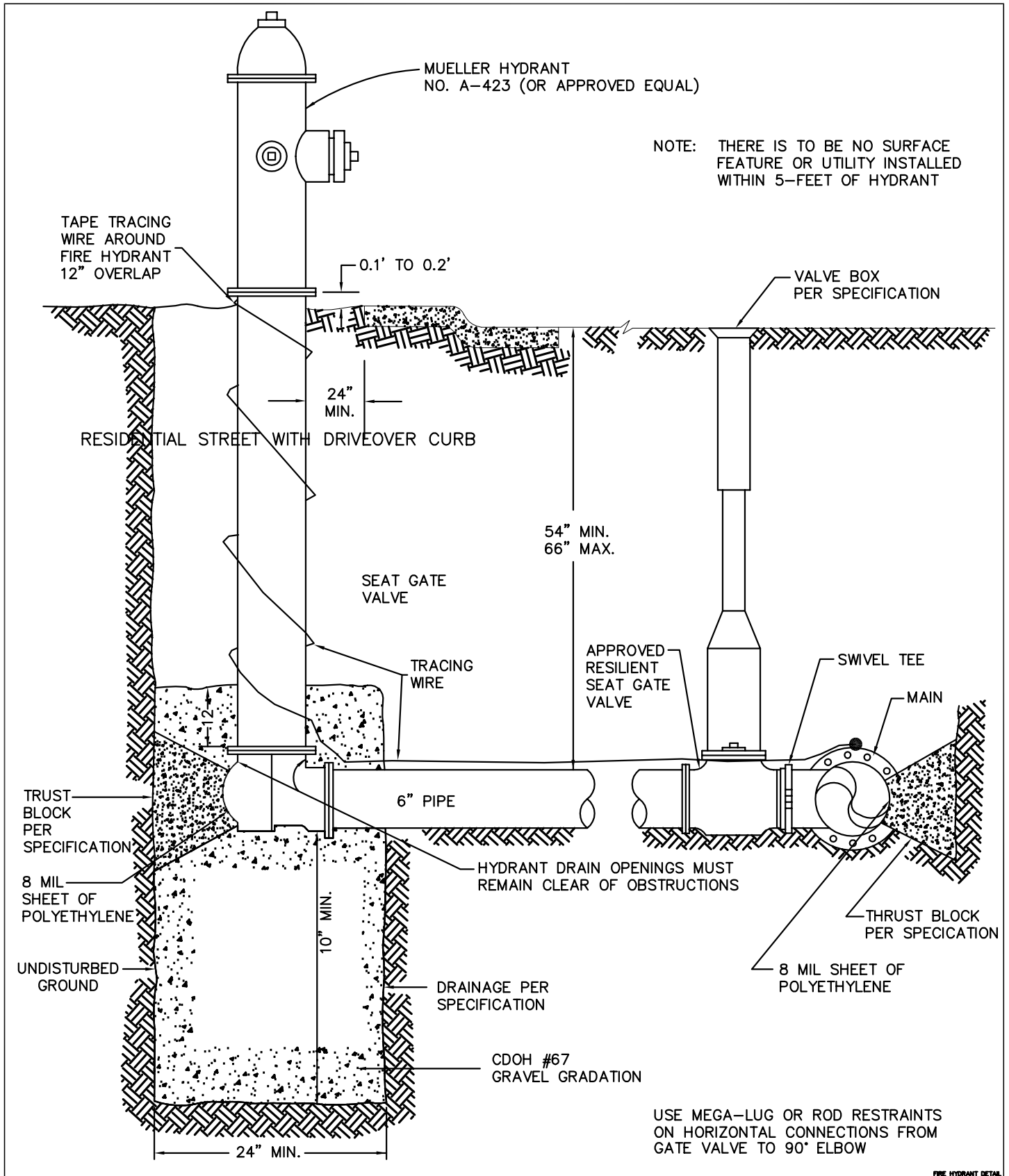
1. Restrain all joints with Megalug or similar mechanical restraint.
2. All exposed metal surfaces shall be poly-wrapped.

*TOWN OF
FIRESTONE*

*CONDUIT CROSSING
DETAIL*

APPROVED BY: MAYOR

TST

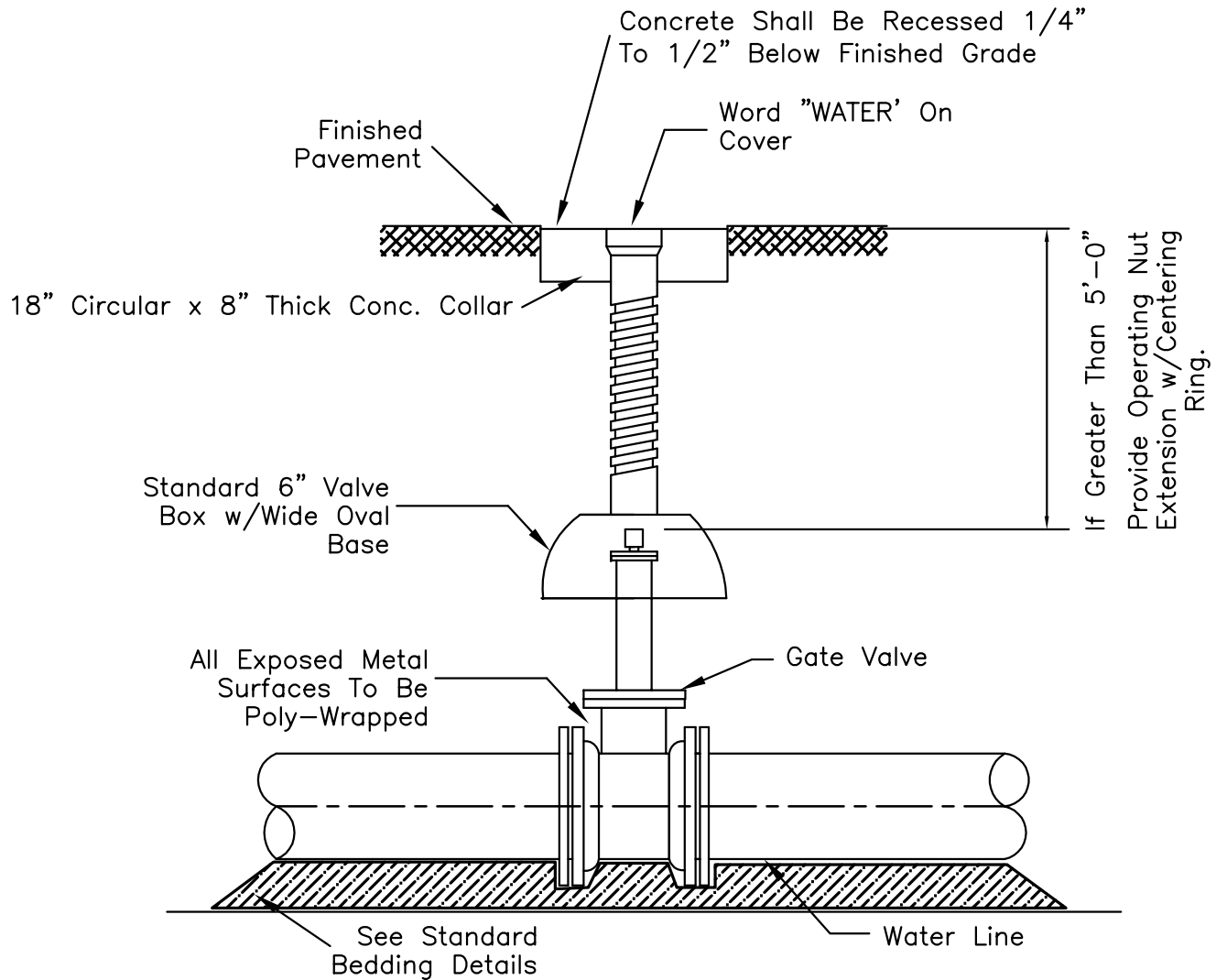


*TOWN OF
FIRESTONE*

*FIRE HYDRANT
DETAIL*

APPROVED BY: MAYOR

TST



NOTE:

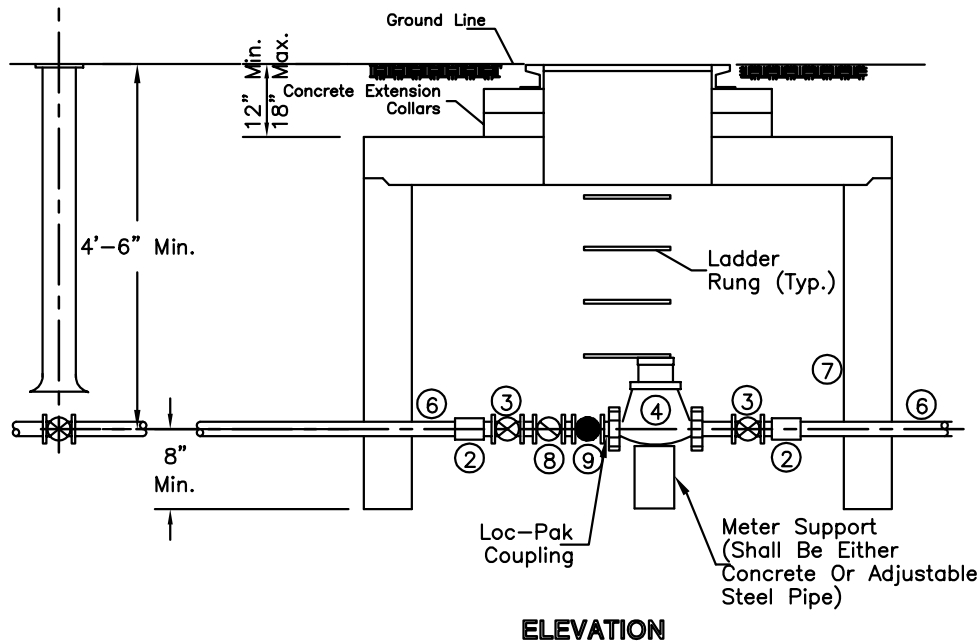
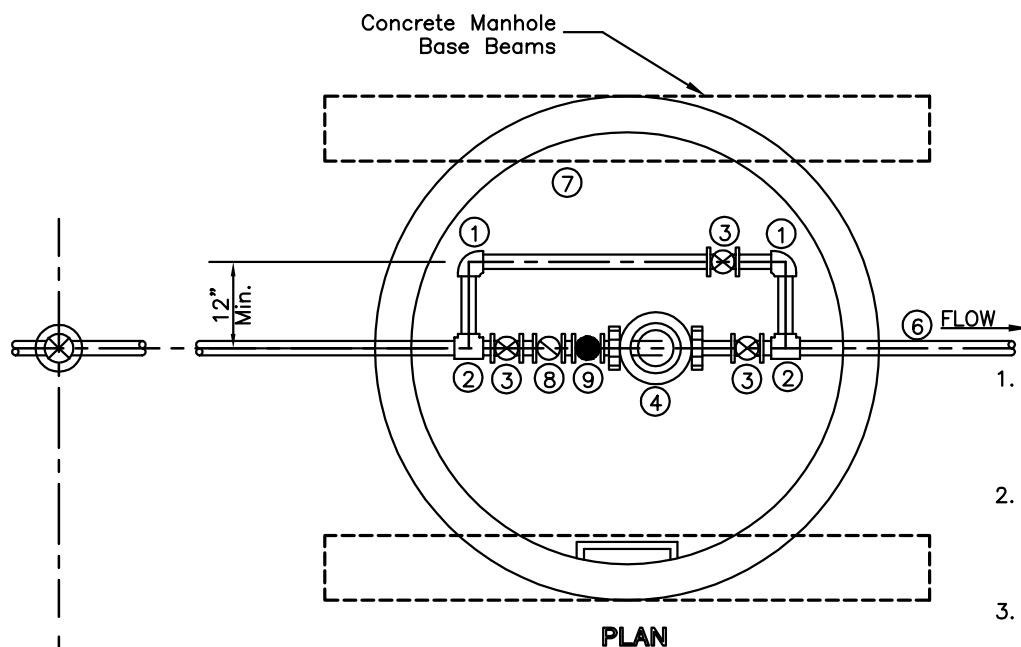
Care Shall Be Taken When Installing Valves On A.C.P. Lines To Assure Proper Support Of The Valve. The Town Will Require Concrete Blocks And/Or 3/4" Washed Rock To Be Installed Under The Valve To Provide Proper Support Where Required.

**TOWN OF
FIRESTONE**

**GATE VALVE
DETAIL**

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- ① – 90° Elbow
- ② – Tee
- ③ – Curb Stop
- ④ – Meter Unit
- ⑤ – Check Valve
- ⑥ – Type "K" Copper Tubing
- ⑦ – 72" Conc. Manhole
- ⑧ – Pressure Reducing Valve
- ⑨ – Strainer

NOTES:

1. Manhole Base Beams Required For Drive-ways, Or Parking Area When Approved.
2. A 72" Ø Manhole Pit Will Accomodate 1-1/2" & 2" Meters w/ Custom Setter.
3. Joints Inside Meter Vault Shall Be Either Threaded Or Soldered w/95-5 Timantimony Solder.
4. No Concrete To Be Laid In Floor Of Meter Manhole.
5. Meter Shall Be Flanged w/ Brass Companion Flanges.
6. No Connections Or Changes In Pipe Diameter Shall Be Made In The Meter Pit Or In The Distance Of Five Feet Beyond The Meter Pit On The Outlet Side.
7. Ladder Rungs Shall Be On The Opposite Side Of Bypass.
8. Bypass Shall Not Be Installed For Use With An Irrigation System.
9. For Building Service – Check Valve To Be Located in the Building. For Irrigation Service – Check Valve To Be Located Outside Of Meter Pit.

**TOWN OF
FIRESTONE**

**1 1/2" AND 2" METER
DETAIL**

APPROVED BY: MAYOR

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GENERAL METER NOTES

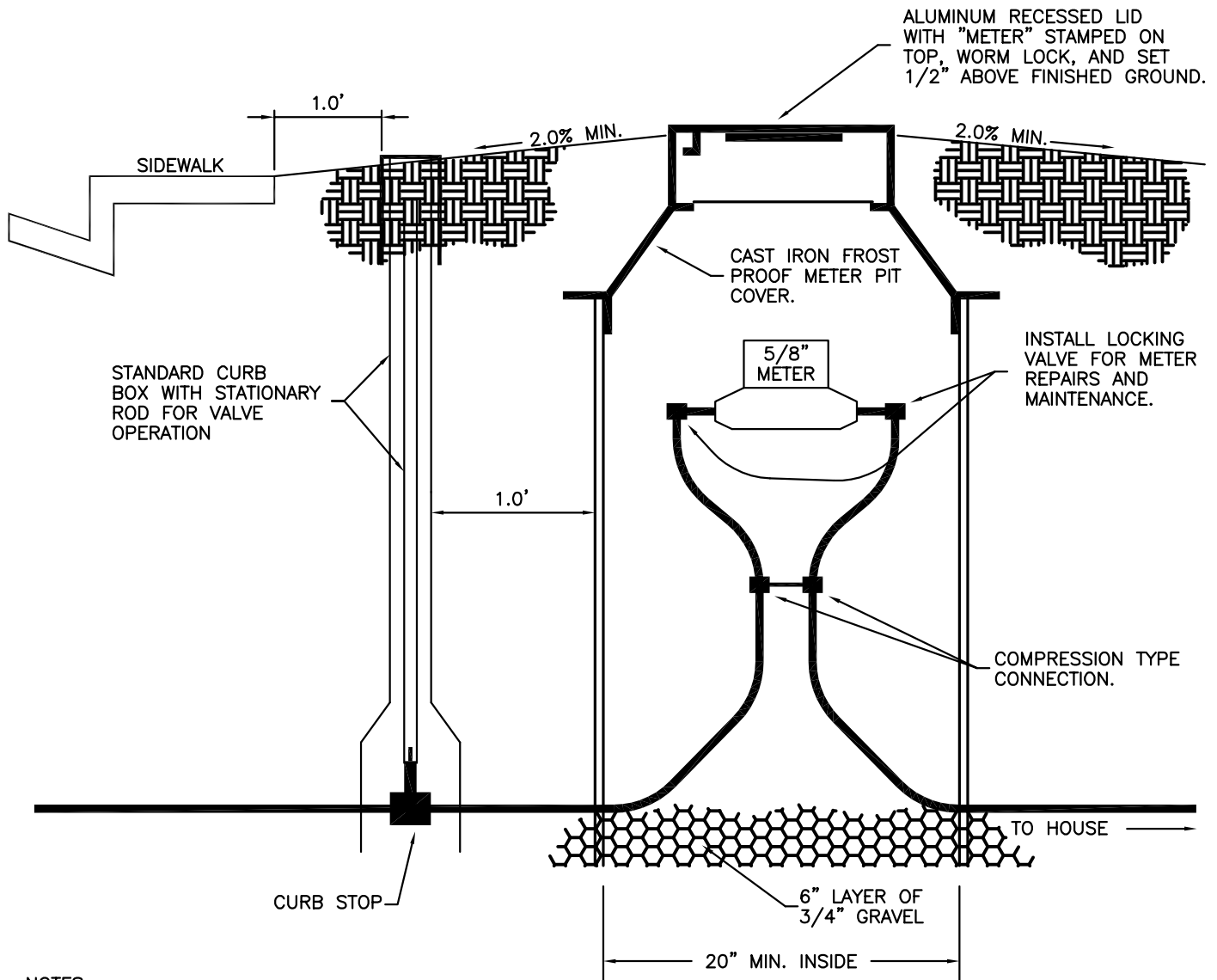
1. Location Of The Meter To Be Established By The Development Engineer.
2. All Settings Must Be Inspected By The Town's Representative.
3. If The Street Or Ground Is Not To Official Grade At The Time Of Installation Of The Meter, The Owner Must Raise Or Lower The Meter Vault When The Final Grade Is Established.
4. Leaded Joints And Galvanized Piping Shall Not Be Allowed Inside The Meter Vaults.
5. A Bypass Is To Be Installed On 1 1/2" And Larger Meters Unless Otherwise Specified.
6. The Service Line Through And On Both Sides Of The Meter Pit Must Be Of The Same Material.
7. No Connections Shall Be Made In The Meter Pit. Sprinkler Connections Must Be Made More Than Five (5) Feet From The Meter Pit On The Downstream Side.
8. GATE VALVES:
 - A. All Gate Valves Under 3" For Use W/Copper Pipe Shall Be All Bronze, w/Non-rising Stems And Solid Wedge Disc, Manufactured In Accordance With A.S.T.M. Spec. B62 And Federal Spec. W.W.-V-54 Class A, 125psi W.S.P., 200psi W.O.G. Or Curb Stops In Accordance With AWWA C800 And MS-23 Of The Material Specifications.
 - B. All Gate Valves 3" And Larger Shall Conform With GOLDEN'S Standard Specifications.
9. All Dresser (Or Approved Equal) Couplings Shall Have The Pipe Stop Removed.

*TOWN OF
FIRESTONE*

*METER
NOTES*

APPROVED BY: MAYOR

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NOTES:

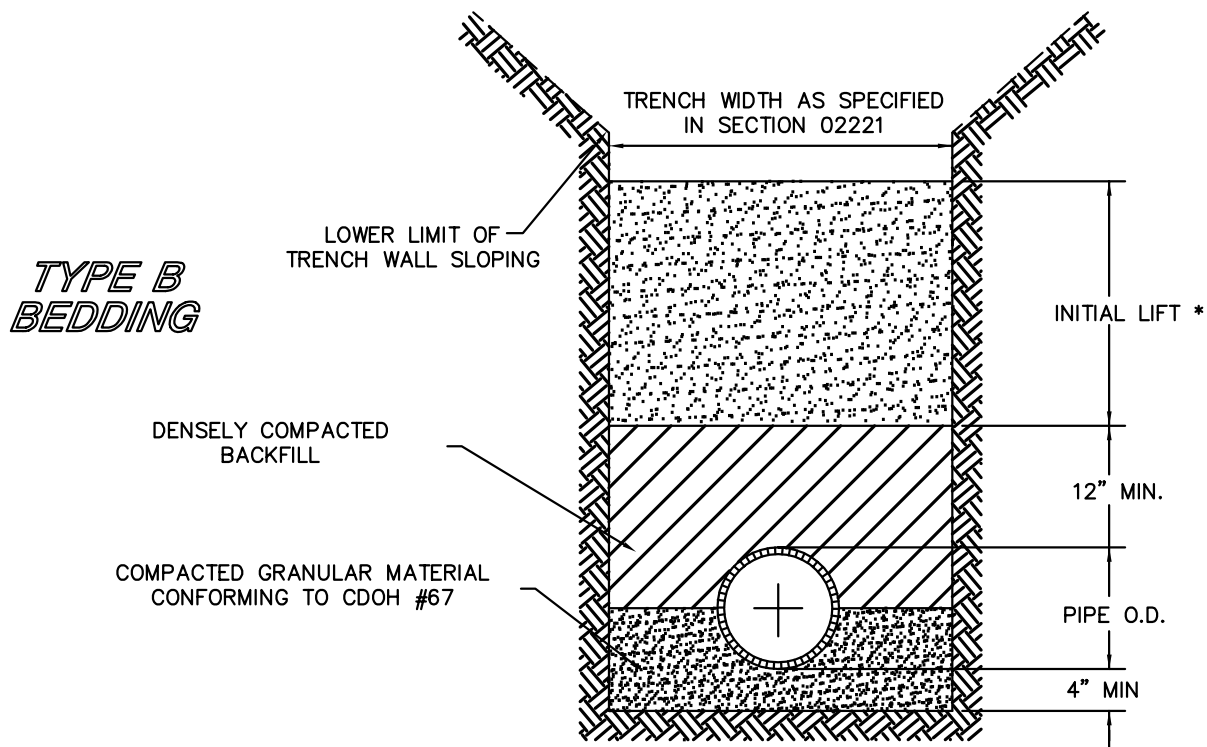
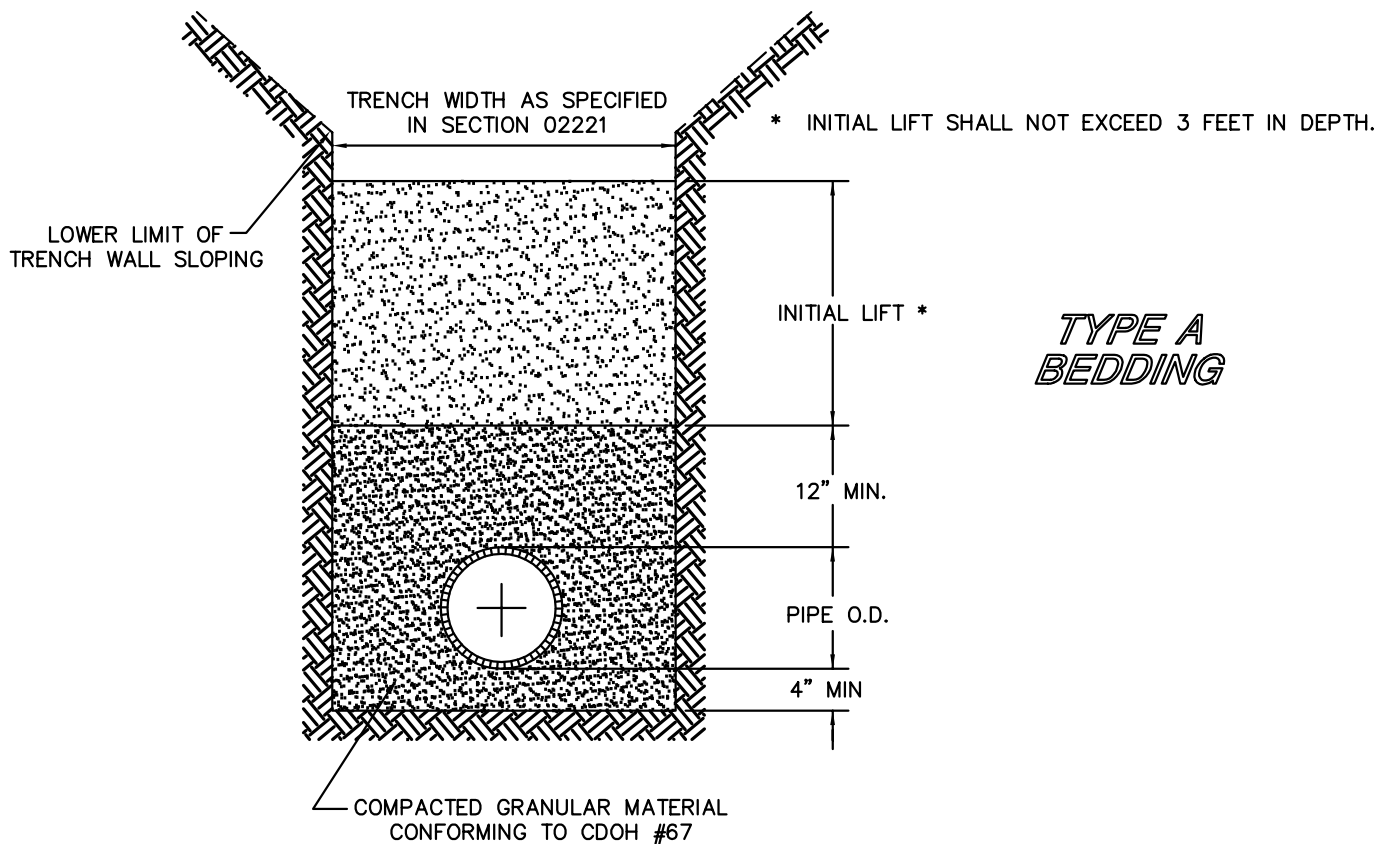
1. METER PIT AND CURB STOP ARE NOT TO BE INSTALLED IN ANY STREET, ALLEY, DRIVEWAY, SIDEWALK, OR PARKING AREA.
2. NO TREES, SHRUBS, BOULDERS, RETAINING WALLS OR OTHER LANDSCAPING FEATURES SHALL BE INSTALLED WITHIN 4' OF THE METER PIT. IF LANDSCAPING CHANGES THE GRADE AROUND THE METER PIT THE OWNER SHALL BE REQUIRED TO ADJUST THE METER PIT COVER TO BE 1/2" ABOVE THE FINISHED GRADE AND ENSURE POSITIVE DRAINAGE AWAY FROM THE METER PIT IN ALL DIRECTIONS.
3. THE TOWN SHALL PROVIDE THE METER, SETTER AND PIT. NOTIFY THE TOWN CLERK ONE WEEK IN ADVANCE OF INSTALLATION SO THAT THE UNITS CAN BE ORDERED IF THERE ARE NONE IN STOCK.
THE TOWN SHALL INSTALL THE METER.
4. METER PITS SHOULD BE INSTALLED DURING CONSTRUCTION OF THE HOME TO ENSURE PROPER LOCATION AND PREVENT DAMAGE DURING THE TIME THE INFRASTRUCTURE IS BEING COMPLETED AND THE HOME IS BUILT.
5. METER PITS FOR COMMERCIAL BUILDINGS OR OTHER APPLICATIONS REQUIRING LARGER METERS WILL BE OF A SIMILAR DESIGN. DETAILS FOR LARGER METERS SHALL BE DISCUSSED ON A CASE BY CASE BASIS WITH THE TOWN BEFORE INSTALLATION.

**TOWN OF
FIRESTONE**

**STANDARD RESIDENTIAL
METER SETTING**

APPROVED BY: MAYOR

TST



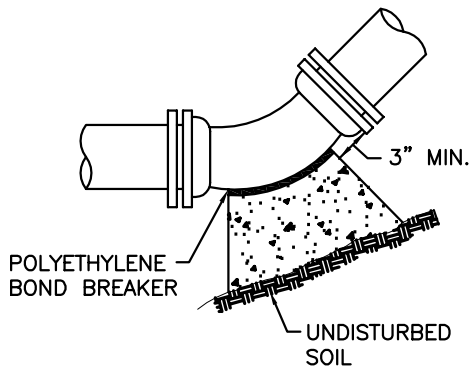
BEDDING REQUIREMENTS

**TOWN OF
FIRESTONE**

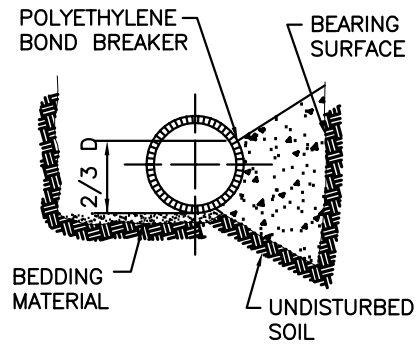
**PIPE BEDDING
DETAIL**

APPROVED BY: MAYOR

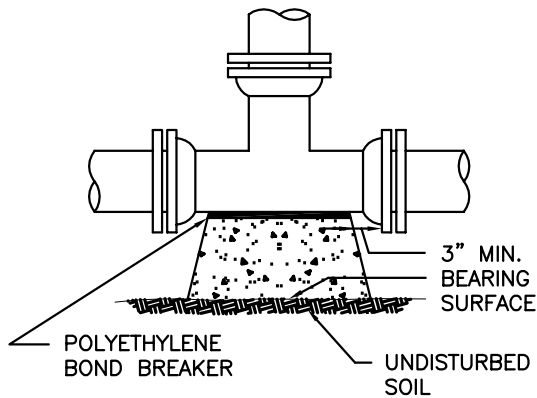
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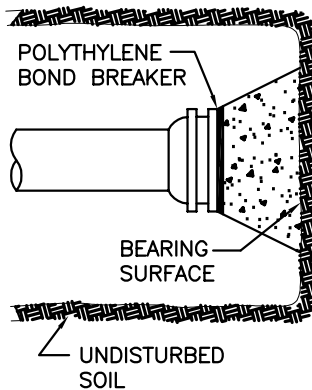
TYPICAL BEND



TYPICAL CROSS SECTION



TEE



DEAD END

| MINIMUM BEARING SURFACE AREA (SQ. FT.) | | | | | |
|---|---------|---------|-----|------|-----------------------|
| PIPE SIZE | BENDS | | | | TEE OR DEAD END |
| | 11 1/4' | 22 1/2' | 45° | 90° | |
| 6" | 1.0 | 1.5 | 2.5 | 4.5 | 3.5 |
| 8" | 1.5 | 2.5 | 4.5 | 8.0 | 5.5 |
| 12" | 3.0 | 4.5 | 9.0 | 16.5 | 12.0 |

GENERAL NOTES:

1. BEARING SURFACE AREAS SHOWN IN CHART ARE MINIMUM.
2. ALL FITTINGS TO BE WRAPPED WITH POLYETHYLENE.
3. PIPE INSTALLED UNDER CONDITIONS DIFFERENT FROM THOSE NORMALLY ENCOUNTERED SHALL REQUIRE THRUST BLOCKS DESIGNED FOR THOSE PARTICULAR CONDITIONS.
4. THRUST BLOCKS ON PIPE LARGER THAN 12" SHALL BE DESIGNED FOR CONDITIONS EXISTING AT THE INSTALLATION SITE.
5. REFER TO SECTION 03300 FOR CONCRETE REQUIREMENTS.

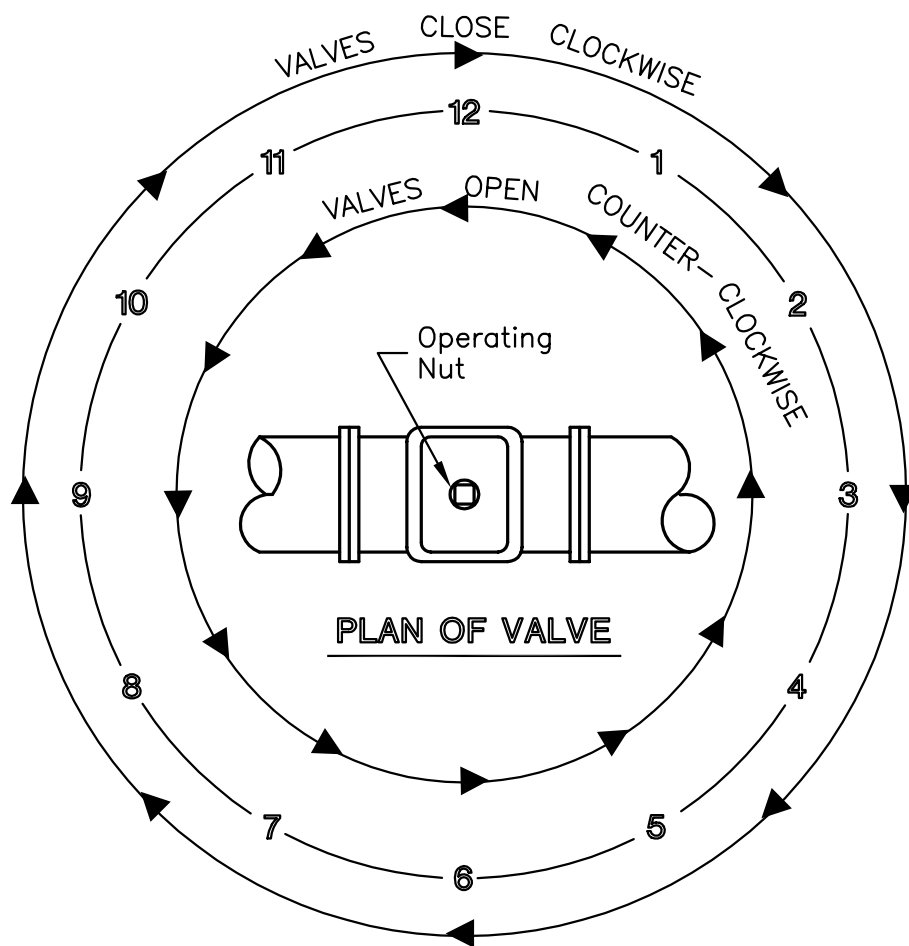
STANDARD CONCRETE THRUST BLOCKS

*TOWN OF
FIRESTONE*

*THRUST RESTRAINT
DETAIL*

APPROVED BY: MAYOR

TST



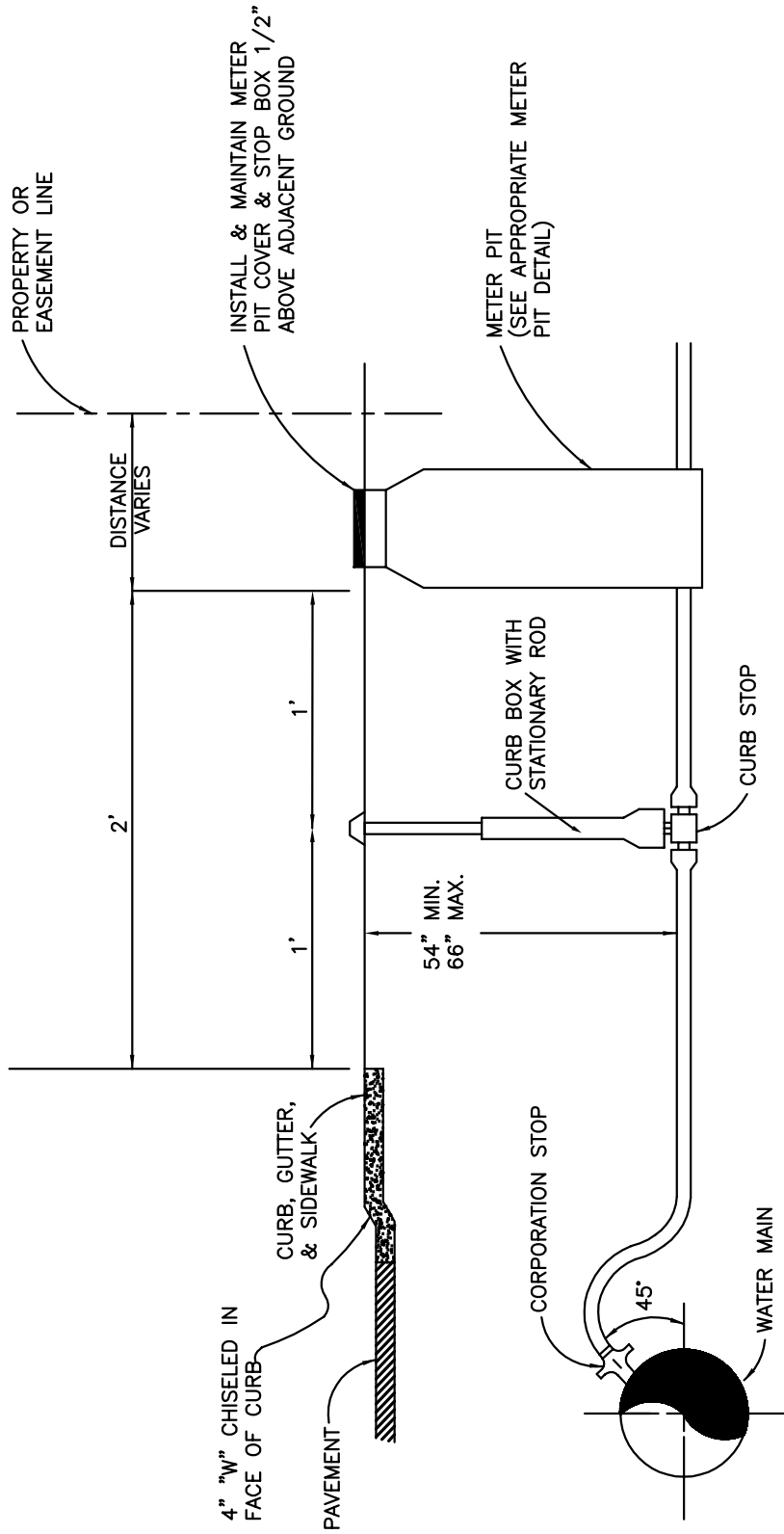
VALVE OPENING & CLOSING PROCEDURE

*TOWN OF
FIRESTONE*

*VALVE OPERATOR
DETAIL*

APPROVED BY: MAYOR

TST



TYPICAL SERVICE DETAIL

GENERAL NOTES:

1. FOR 5/8-INCH THROUGH 1-INCH SERVICES, USE DIRECT TAP AS SHOWN.
2. FOR 1 1/2-INCH AND 2-INCH SERVICES, INSTALL WITH TAPPED TEE AND CORPORATION STOP AT TIME OF CONSTRUCTION OR USE A TAPPING SADDLE.
3. LOCATION OF CURB BOX AND METER PIT SHALL BE ACCORDING TO APPROVED UTILITY DRAWINGS.
4. CITY'S RESPONSIBILITY FOR MAINTENANCE SHALL BE THE WATER MAIN, CORPORATION STOP, SERVICE PIPING UP TO AND INCLUDING THE CURB STOP. OWNER'S RESPONSIBILITY SHALL BE FROM CURB STOP (INCLUDING THE OUTLET COUPLING) TO THE BUILDING.
5. NO COUPLINGS SHALL BE ALLOWED BETWEEN CURB STOP AND METER SETTER.
6. SERVICE SHALL BE TYPE K COPPER FROM CORPORATION STOP TO 5-FOOT PAST METER PIT (MINIMUM).

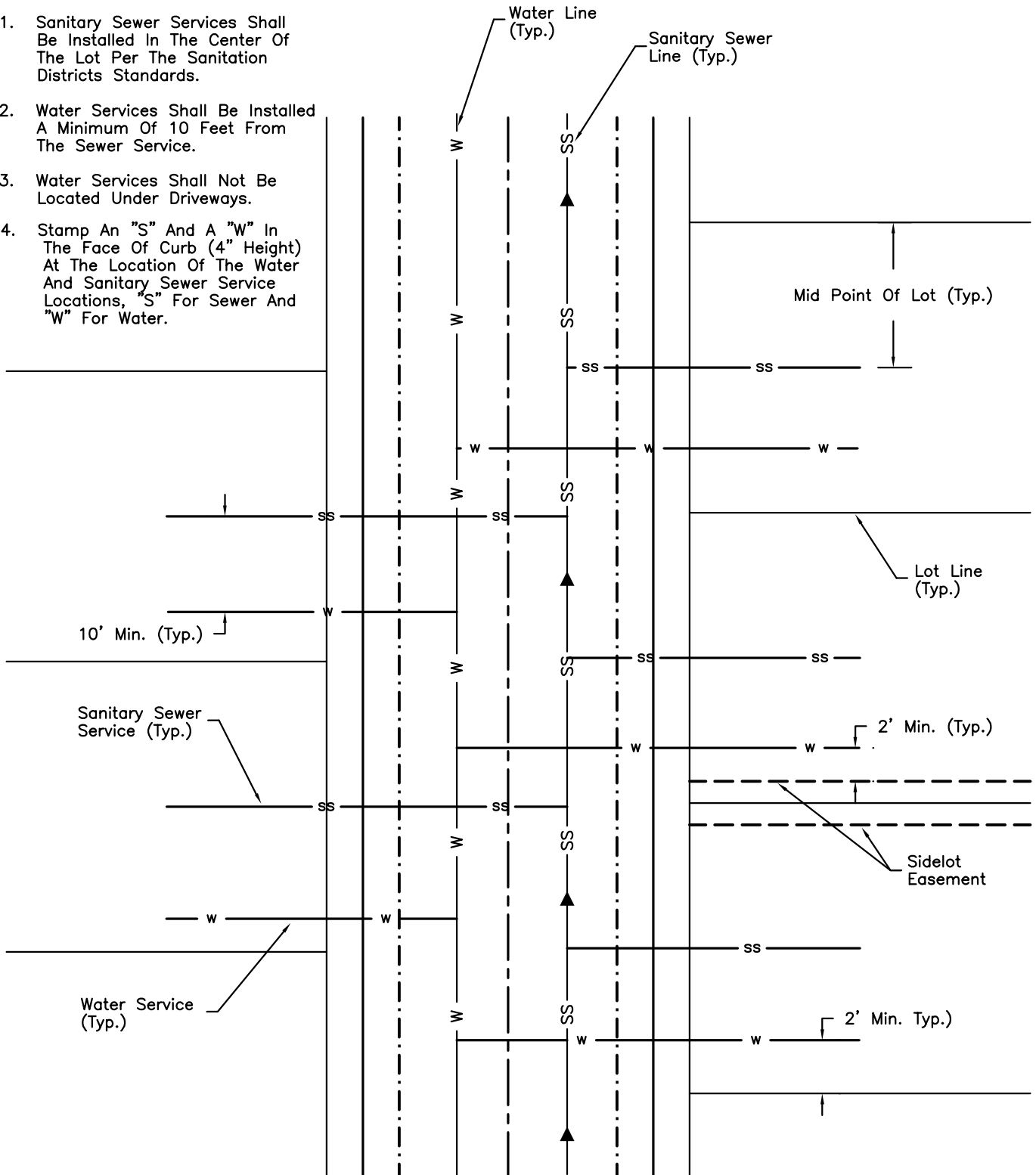
*TOWN OF
FIRESTONE*

*WATER SERVICE
DETAIL*

APPROVED BY: MAYOR

TST

1. Sanitary Sewer Services Shall Be Installed In The Center Of The Lot Per The Sanitation Districts Standards.
2. Water Services Shall Be Installed A Minimum Of 10 Feet From The Sewer Service.
3. Water Services Shall Not Be Located Under Driveways.
4. Stamp An "S" And A "W" In The Face Of Curb (4" Height) At The Location Of The Water And Sanitary Sewer Service Locations, "S" For Sewer And "W" For Water.



*TOWN OF
FIRESTONE*

*WATER AND SEWER
SERVICE LOCATIONS*

APPROVED BY: MAYOR

TST